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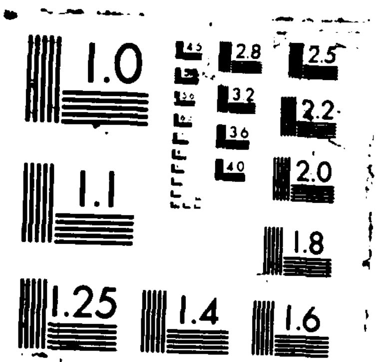
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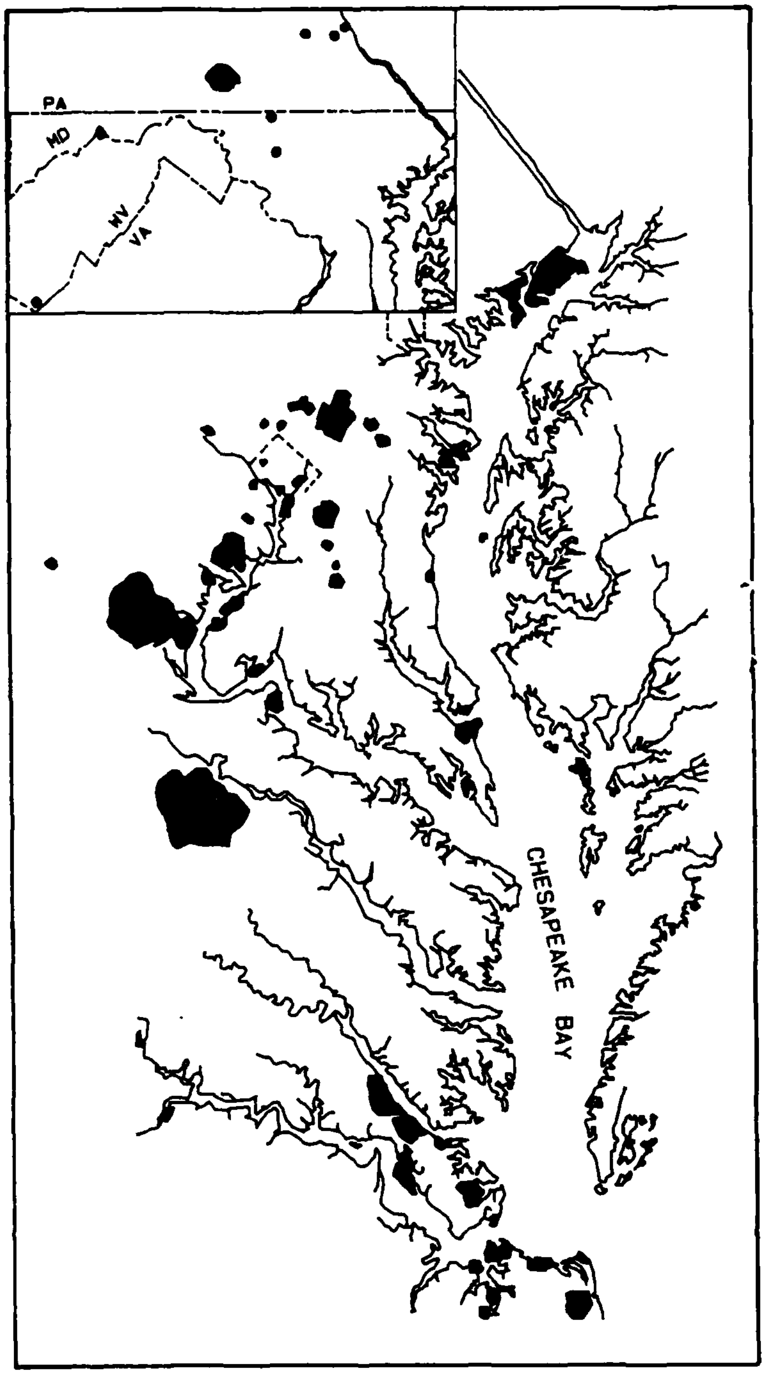
AD-A190 074

WATER QUALITY ASSESSMENT OF DOD INSTALLATIONS/ FACILITIES IN THE CHESAPEAKE BAY REGION



PHASE III REPORT

VOLUME 2 - OVERALL APPROACH, FINDINGS AND RECOMMENDATIONS

NOVEMBER 1987

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This report represents the culmination of a two-year, three-phase effort to determine the relative impact of DoD activities on the water quality and living resources of the Chesapeake Bay.
Phase I defined the recent historical and present pollution potential of all 66 DoD installations in the Bay's drainage basin, and developed a preliminary screening procedure to categorize these installations according to existing or potential impacts on the Bay and its tributaries. Phase II developed and tested a detailed assessment methodology on six installations to define the character and extent of their impact on the Bay. Phase III applied this tested methodology to the remaining 31 installations identified in Phase I as needing more detailed assessment, and summarizes impacts and program recommendations from an installation, regional, and Bay-wide perspective. Volume 2 presents detailed results of this analysis.

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WATER QUALITY ASSESSMENT
OF DOD INSTALLATIONS/FACILITIES
IN THE CHESAPEAKE BAY REGION

PHASE III REPORT

VOLUME 2
OVERALL APPROACH,
FINDINGS AND RECOMMENDATIONS

Prepared for:
Deputy Assistant Secretary of Defense
for Environment
and
U.S. Army Corps of Engineers
Baltimore District
Contract DACA 31-85-C-0168

Prepared by

Tetra Tech, Inc.
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November 1987

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This report was prepared for the Office of the Deputy Assistant Secretary of Defense for Environment by Tetra Tech, Inc., under Contract DACA 31-85-C-0168, approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Department of Defense. Some of the findings and recommendations in this report are based on preliminary data or limited data sets, and are subject to revision as further information becomes available.

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(Phase III Report, Volume 2)

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LIST OF ACRONYMS AND ABBREVIATIONS USED IN THE TEXT

AA	Anacostia Annex
ABL	Allegany Ballistics Laboratory
AEHA	Army Environmental Hygiene Agency
AAFB	Andrews Air Force Base
AFB	Air Force Base
AFES	Armed Forces Exchange Service
APG	Aberdeen Proving Ground
ASC	Arlington Service Center
AWT	Advanced Wastewater Treatment plant
BOD	Biochemical Oxygen Demand
BPF	Blossom Point Field Test Facility
BRHA	Brandywine Reciver and Housing Annex
CAMSTA	Cameron Station
CAX	Naval Supply Center - Cheatham Annex
CB	Carlisle Barracks
CBOD	Carbonaceous Biochemical Oxygen Demand
CBD	Chesapeake Bay Detachment
CBI	Chesapeake Bay Institute
CBP	Chesapeake Bay Program
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
cfs	Cubic Feet per Second
CHESDIV	Chesapeake Division, U.S. Department of Navy
COD	Chemical Oxygen Demand
CPU	Central Processor Units
CRC	Chesapeake Research Consortium
DARCOM	United States Army Material Development and Readiness Command
DDM	Defense Depot, Mechanicsburg
DER	Department of Environmental Resources
DESR	Defense Environmental Status Report
DGSC	Defense General Supply Center
DLA	Defense Logistics Agency
DMR	Discharge Monitoring Report
DNR	Department of Natural Resources
DO	Dissolved Oxygen
DoD	Department of Defense
DPDO	Defense Property Disposal Office
DRMO	Defense Reutilization and Marketing Office
DTNSRDC	David Taylor Naval Ship Research and Development Center
EEA	Explosive Experimental Area
EFD	Engineering Field Division
EMP	Electromagnetic Pulses
EMRC	Electronic Material Readiness Command
EOD	Explosive Ordnance Disposal
EPA	Environmental Protection Agency
EPIC	Environmental Photographic Interpretation Center

FGGM	Fort George G. Meade
fps	Feet per Second
FTL	Fort Lee
FYM	Fort Myer
GPD	Gallons per Day
HDL	Harry Diamond Laboratory
HRSD	Hampton Roads Sanitation District
HF	High Frequency
IRP	Installation Restration Program
IWTP	Industrial Wastewater Treatment Plant
kg	Kilograms
LUST	Leaking Underground Storage Tank
LEAD	Letterkenny Army Depot
LOTS	Logistics Over The Shore
MCDEC	Marine Corps Development and Education Command
MCL	Maximum Contaminant Level set by EPA
MD	Maryland
MDW	Military District of Washington
MGD or mgd	Million Gallons per Day
mg/L or mg/l	Milligrams per Liter
NACIP	Navy Assessment and Control of Installation Pollution
NARF	Naval Air Rework Facility
NAS	Naval Air Station
NASA	National Aeronautics and Space Administration
NAS/NATC	Naval Air Station/Naval Air Test Center
NAVCAMS LANT	Naval Communication Area Master Station, Atlantic
NAVFAC	Naval Facilities
NAVRADSTA	Naval Radio Station Sugar Grove
NAVSEASYSCOM	Naval Sea System Command
NAVSTA	Naval Station
NCAD	New Cumberland Army Depot
NCU	Naval Communications Unit
NEESA	Naval Energy and Environmental Support Activity
NEIC	National Enforcement Investigations Center
NEPA	National Environmental Policy Act
NESEA	Naval Electronics Systems Engineering Activity
NMCNCR	Naval Medical Command National Capitol Region
NNSY	Norfolk Naval Shipyard
NOBSY	United States Naval Observatory
NOS	Naval Ordnance Station
NPDES	National Pollutant Discharge Elimination System
NRL	Naval Research Laboratory
NRL-CBD	Naval Research Laboratory - Chesapeake Bay Detachment
NRTC	Naval Radio Transmitter Center
NSA	National Security Agency
NSC	Naval Supply Center
NSPCC	Navy Ships Parts Control Center
NIPDWR	National Interim Primary Drinking Water Regulations
NWSY	Naval Weapons Station - Yorktown
ODU	Old Dominion University
OEHL	Occupational and Environmental Health Laboratory
OEP	Office of Environmental Programs

OMTAP	Operation, Maintenance, and Training Assistance Program
PA	Pennsylvania
PCB	Polychlorinated biphenyls
PCS	Permit Compliance System
PES	Potomac Embayment Standards
POL	Petroleum, Oils and Lubricants
POTW	Publicly Owned Treatment Works
POV	Privately Owned Vehicles
ppt	Parts per Thousand
PWC	Public Works Center
RCRA	Resource Conservation and Recovery Act
REDOX	Reduction and oxidation
RMCL	Recommended Maximum Contaminant Level set by EPA
SAS	Statistical Analysis System, trademark of SAS Institute
SAV	Submerged Aquatic Vegetation
SOD	Sediment Oxygen Demand
SPCC	Spill Prevention Control and Countermeasures
STORET	EPA's Storage and Retrieval environmental database
STP	Sewage Treatment Plant
TAC	Tactical Air Command
TECOM	Test and Evaluation Command
TRADOC	United States Army Training and Doctrine Command
TSD	Treatment, Storage, and Disposal
TSS	Total Suspended Solids
μg/L or ug/L	Micrograms per Liter
USA	United States Army
USAES	Uniter States Army Engineer School
USAF	United States Air Force
USATHAMA	United States Army Toxic and Hazardous Materials Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
USN	United States Navy
USNA	United States Naval Academy
USNA	United States Naval Academy Farm
UST	Underground Storage Tank
UV	Ultraviolet light
VA	Virginia
VHFS	Vint Hill Farms Station
VIMS	Virginia Institute of Marine Science
VSWCB	Virginia State Water Control Board
WASH/COG	Metropolitan Washington Council of Governments
WES	Waterways Experimental Station
WNY	Washington Naval Yard
WO	White Oak
WRAMC	Walter Reed Army Medical Center
WRF	Woodbridge Research Facility
WRPB	Washington Metropolitan Water Resources Planning Board
WSSC	Washington Suburban Sanitation Commission
WTP	Water Treatment Plant
WV	West Virginia

1.0 INTRODUCTION

1.1 THE CHESAPEAKE BAY

Chesapeake Bay, (Figure 1.1), located on the east coast of the United States, is one of the largest and most productive estuaries in the world. The mainstem of the Bay extends approximately 190 miles from Cape Henry, Virginia, to the mouth of the Susquehanna River. The Chesapeake Bay is a submerged river valley, a remnant of the Susquehanna River Valley which was inundated with rising sea level after the most recent glacial period. The average depth of the estuary is approximately 28 feet with a natural channel of 50 feet or deeper traversing the Bay for approximately 60% of its length. The deepest point in the Bay is located near Bloody Point on Kent Island, Maryland where depths reach 180 feet.

The Bay is irregular in shape. Widths range from 4 miles at Kent Island to approximately 30 miles near the mouth of the Potomac River. The estuary is fed by more than 50 tributaries comprising the 64,000 square mile drainage area, however, 90% of the freshwater contributed to the bay originates in five major tributaries; the Susquehanna, Potomac, James, York, and Rappahannock Rivers. The Susquehanna, draining from Pennsylvania and New York provides approximately half of the Bay's freshwater.

Tidal amplitudes are relatively low (generally less than 3 feet) and corresponding tidal currents run less than 3 feet per second (fps), although wind usually dominates the currents in the more shallow reaches of the estuary. Due to its elongated shape, the tidal flushing time of the Bay is relatively long.

The saltwater regime has been characterized as moderately stratified, however, the dynamic nature of the estuary and the great variability of the freshwater contribution causes the Bay to range from highly stratified to well mixed, both spatially and temporally.

As with most estuaries, the Chesapeake Bay is host to a highly productive biological community which supports a large commercial and sport fishery quite important to the regional economy. The recreational importance of the Bay to the region's nearly 15 million residents is also great and the resulting tourist industry thrives.

In recent decades, however, as attention has been focused on the Nation's water resources, it has become apparent that water quality in the Chesapeake Bay is, and has been for some time, in decline. The decline in water quality has been most telling on the biological communities. Harvests of most of the traditional commercial species have declined over the years until recently there have been restrictions on the taking of some anadromous finfish (shad and striped bass) in Maryland and Virginia. Oyster harvests have also dramatically declined in the last 100 years. Some species such as the blue crab and menhaden have increased in recent

Figure 1.1 The Chesapeake Bay

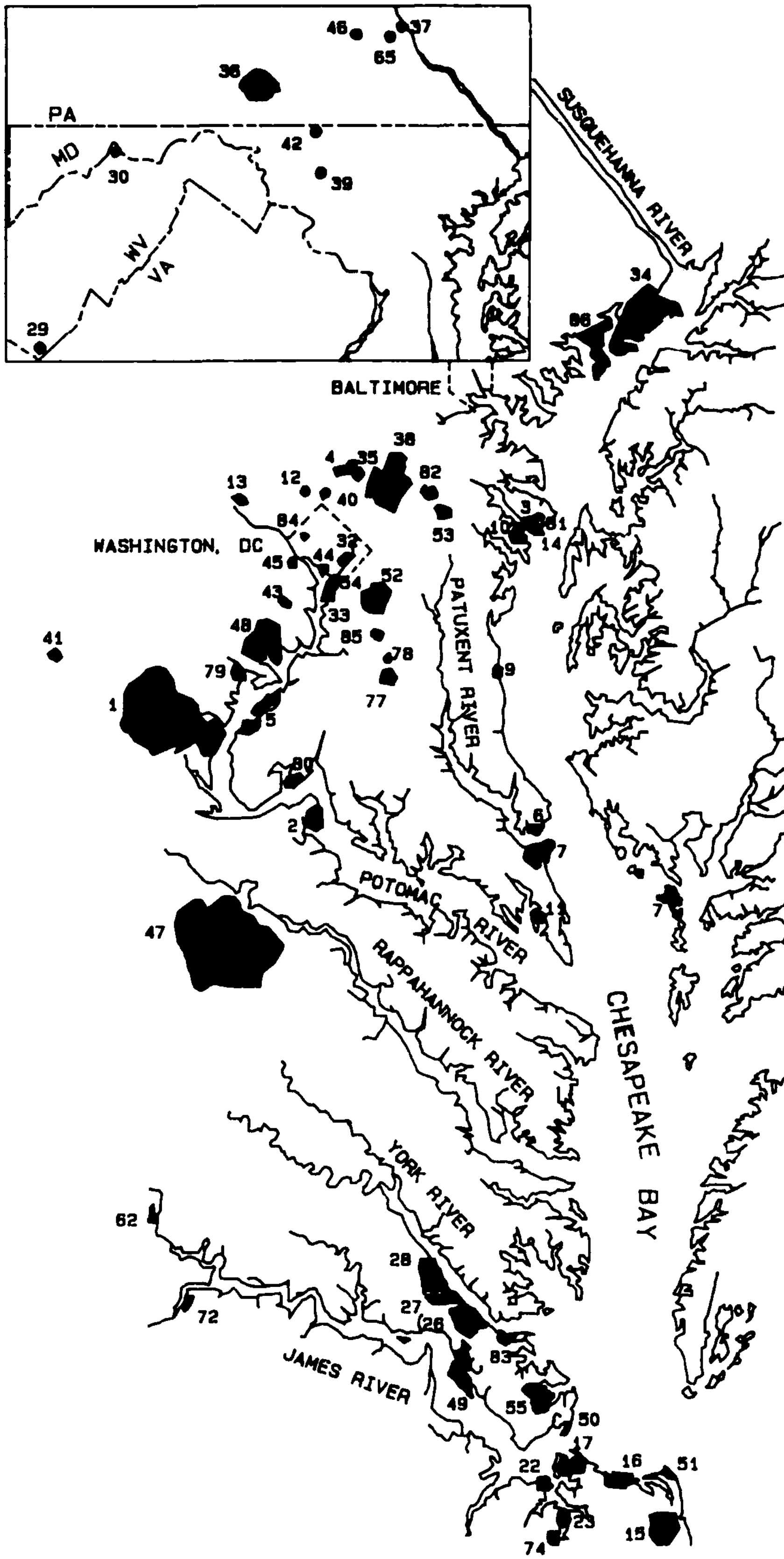
years, but these are either marine spawners or spawn in the marine portions of the estuary. Populations of submerged aquatic vegetation (SAV) have declined dramatically in the last 20 years in the upper estuary, decreasing the protective habitat for many species during their critical nursery lifestages.

The causes of the estuary's decline are many. Some reductions in population are due to naturally recurring cycles in the life histories of organisms and to the natural geomorphological decline of the estuary, however, the acceleration of this decline is viewed by many to be the direct result of anthropogenic (man-induced) influences on the bay.

1.2 BACKGROUND

Federal agencies, including the Environmental Protection Agency (EPA), the Fish and Wildlife Service (FWS), the National Oceanic and Atmospheric Administration (NOAA) and the Department of Defense (DoD), in cooperation with the States of Maryland, Pennsylvania, and Virginia, and the District of Columbia, have planned extensive activities under a cooperative approach towards improving and restoring the environmental quality of the Chesapeake Bay. President Reagan in his State of the Union address in January 1984 stated, "Though this is a time of budget restraints....we will begin the long, necessary effort to clean up....the Chesapeake Bay."

DoD has actively participated in pollution abatement efforts in the Chesapeake Bay area, and has achieved significant progress at military installations, including major sewage treatment plant (STP) upgrades, environmental self auditing, and implementation of a training program for STP operators. The participation of DoD in the Chesapeake Bay Restoration and Protection Plan was made official on 13 September, 1984 when the EPA and DoD signed a Joint Resolution on Pollution Abatement in the Chesapeake Bay (see Appendix A). The Joint Resolution outlined a number of objectives for pollution abatement by DoD, including participation on the Implementation Committee of the Chesapeake Bay Program, upgrading of natural resources and land management plans to include control of nonpoint source discharges, continued provision of data and information on all wastewater discharge permits under the National Pollutant Discharge Elimination System (NPDES), priority funding of pollution abatement projects in the Chesapeake Bay area, and conducting the study described herein. Of particular interest to DoD in conducting this study is to determine the relative impact of DoD actions (beneficial or adverse) on the water quality and living resources of the Bay. This information, coupled with the State and EPA programs, will afford DoD components a framework to develop appropriate improvement plans. These plans will include studies, practices or projects that can be implemented at specific locations, where necessary, to restore and protect water quality and living resources of the Bay. A list of the 66 DoD installations under evaluation and their approximate locations is given in Figure 1.2.



AIR FORCE
52 Andrews Air Force Base
54 Bolling Air Force Base
78 Brandywine DRMO
77 Brandywine Rec. & Housing Annex
53 Davidsonville RDV Site
55 Langley Air Force Base

ARMY
34,86 Aberdeen Proving Ground
43 Cameron Station
46 Carlisle Barracks
47 Fort A.P. Hill
48 Fort Belvoir
39 Fort Detrick
49 Fort Eustis
72 Fort Lee
44 Fort McNair
38 Fort Meade
50 Fort Monroe
45 Fort Myer
42 Fort Ritchie
51 Fort Story
35 Harry Diamond Lab - Adelphi
80 Harry Diamond Lab-Blossom Point
79 Harry Diamond Lab - Woodbridge
36 Letterkenny Army Depot
37 New Cumberland Army Depot
41 Vint Hill Farms Station
40 Walter Reed Army Medical Center

DEFENSE LOGISTIC AGENCY
62 Defense General Supply Center

NAVY
30 Allegany Ballistics Laboratory
28 Camp Peary
14 David Taylor NSRDC - Annapolis
13 David Taylor NSRDC - Carderock
17-21 Sewells Point Naval Complex
15 Naval Air Station - Oceana
7,8 NAS/NATC - Patuxent River
6 Naval Air Sta. - Solomons Annex
16 Naval Amph. Base - Little Creek
85 Naval Communications Unit
11 Naval Elect. Sys. Engr. Act.
12 Naval Medical Command - NCR
84 Naval Observatory - Wash., DC
5 Naval Ord. Station-Indian Head
29 Naval Radio Station-Sugar Grove
81 Naval Radio Trans. - Annapolis
33 Naval Research Lab - Wash., DC
9 Naval Research Lab - CBD
23 Naval Shipyard - Norfolk
3 Naval Station - Annapolis
27 Naval Sup. Cen.-Cheatham Annex
22 Naval Supply Center-Craney Is.
83 Naval Supply Center-Yorktown
2 NSWC - Dahlgren
4 NSWC - White Oak
26 Naval Weapons Station-Yorktown
65 Navy Ships Parts Control Center
74 St. Juliens Creek Annex
1 U.S. Marine Corps - Quantico
10 U.S. Naval Academy - Annapolis
82 U.S. Naval Academy Farm
32 Washington Navy Yard

Figure 1.2 Location of the 66 DoD Installations Under Evaluation. [Note: numbers 7, 17, and 34 are complexes of two or more installations.]

1.3 PURPOSE

This study serves as a framework and guidance tool for use by DoD components in executing pollution abatement activities at selected installations where water quality and biological trends are affected. Specifically, the study was designed to:

- Summarize DoD impacts by installation, tributary (regional), and Bay-wide;
- Identify the most effective DoD projects and programs that have either protected Bay resources or reduced adverse impacts on the Chesapeake Bay; and
- Provide recommendations as to additional detailed studies, practices or projects that could be implemented at specific locations to restore and protect water quality conditions and living resources of the Chesapeake Bay.

The water quality assessment study was managed for DoD by the Baltimore District, U.S. Army Corps of Engineers. The technical contractor was Tetra Tech, Inc, of Arlington, Virginia. Their subcontractor, SCI Data Systems, Inc. and consultant Dr. Donald Lear, are both of Annapolis, Maryland.

The study has required extensive coordination with the military Services, Commands, and DoD installations. In addition, the study has required data collection from the EPA and agencies in the States of Maryland, Pennsylvania, and Virginia.

It is emphasized that this is a surface water quality oriented study, and is not an environmental assessment of DoD activities in the Chesapeake Bay region. In addressing water quality concerns, however, a wide range of activities has been examined, which affords the opportunity to identify needed improvements in areas that may have indirect effects on surface water quality. Such areas include, for example, storage and disposal of hazardous materials and/or wastes, munitions production and testing, groundwater contamination, and maintenance operations. Table 2.2 lists the activities that have been examined for potential water quality impacts.

1.4 SCOPE OF WORK

The study consists of three phases over a twenty-four (24) month schedule as shown in Figures 1.3 and 1.4.

1.4.1 Phase I

Phase I of the study was completed in October, 1986. This phase defined the recent historical and present pollutant sources, and developed a preliminary screening system to classify DoD installations according to

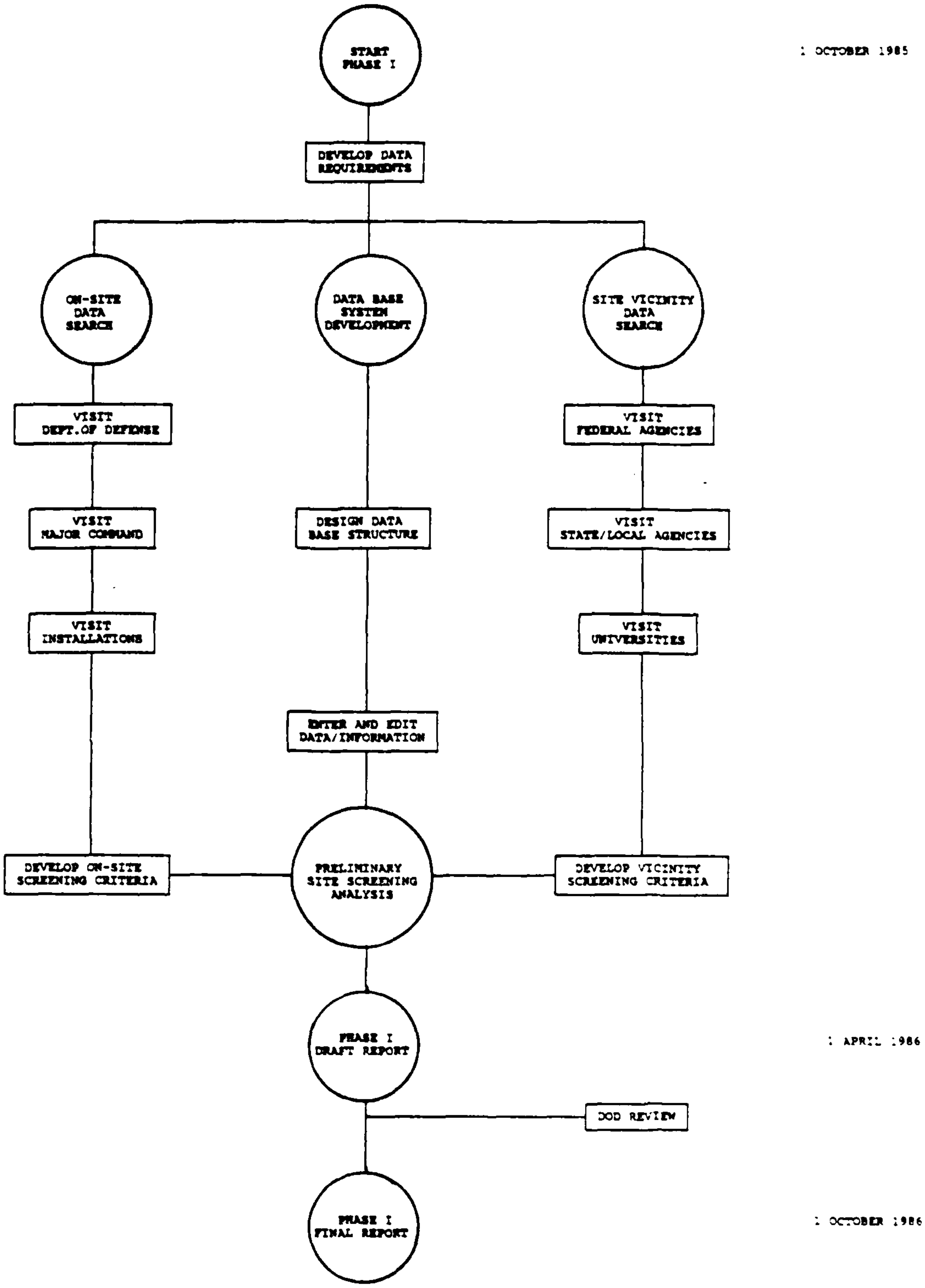


Figure 1.3 Flow Chart of Phase I

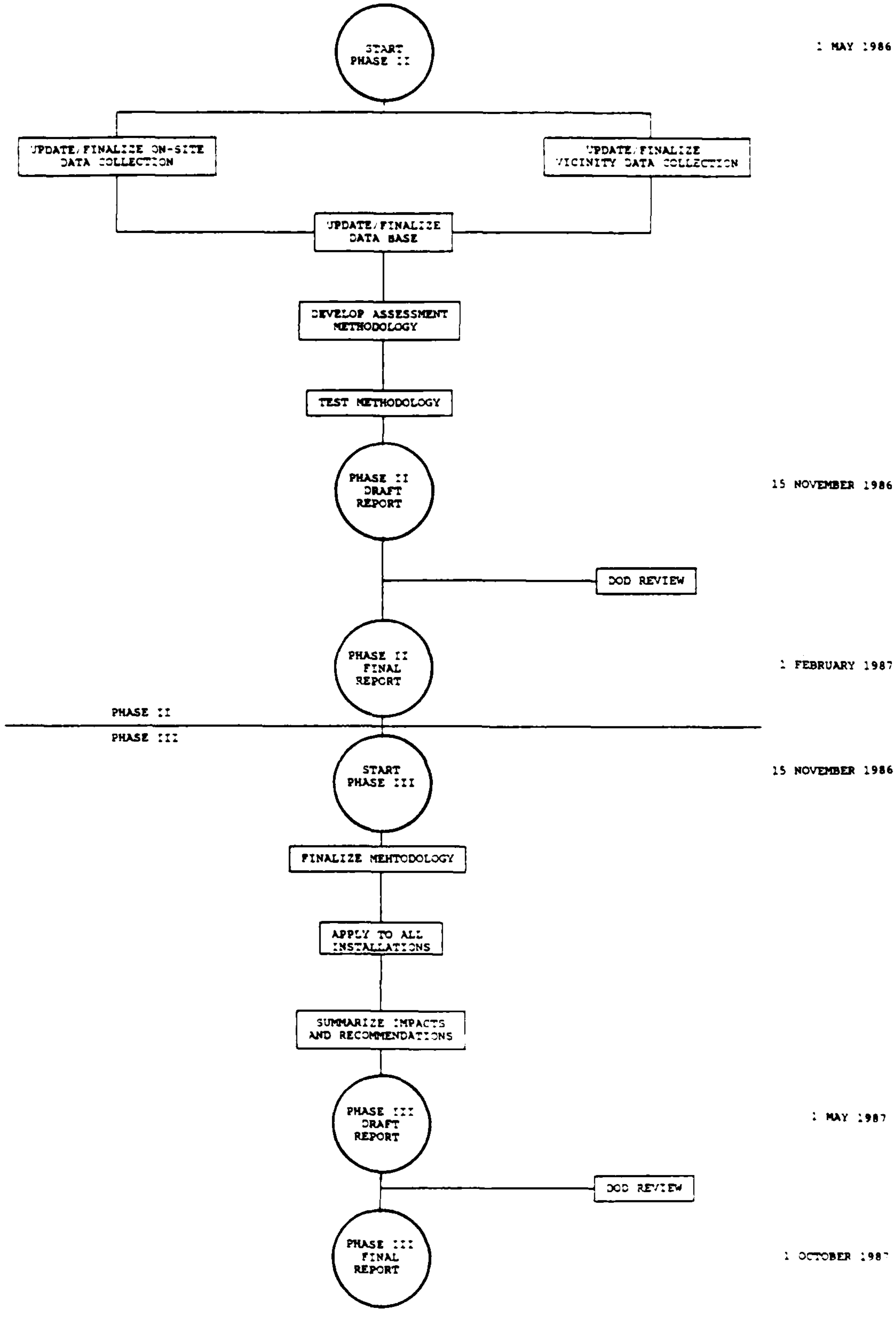


Figure 1.4 Flow Chart of Phases II and III

existing (if known) or potential impacts on the Bay and its tributaries. A total of 66 DoD installations are included in this study. They include 37 Navy (USN), 22 Army (USA), 6 Air Force (USAF) and 1 Defense Logistics Agency (DLA). The 66 installations were selected by DoD to include those installations that have the potential for impacting water quality and living resources of the Bay and its tributaries. A list of the 66 DoD installations under evaluation and a map showing their approximate locations are given in Figure 1.2.

During Phase I, the preliminary screening system was applied to all 66 DoD installations under evaluation. The screening system identified those installations that have:

- A significant* potential for environmental impact and thus were the focus of a more detailed assessment in Phases II and III of the study (Study Group 1);

- Unknown or poorly defined but likely significant potential for environmental impact and were included in the subsequent assessment procedures in Phases II and III of the study (Study Group 2);

- An insignificant potential for environmental impact and therefore were not included in the more detailed assessment procedures (Study Groups 3 and 4).

Installations included in the first two study groups received additional focus under Phases II and III of this study. Installations screened under Study Groups 3 and 4 did not receive additional study; however, they have been included in the final Phase III overview. In addition, they have been included, where appropriate, in the final Phase III set of study recommendations. Results of the Phase I screening are presented in the Phase I report (Tetra Tech, 1986). A summary of these results is given below.

Twelve installations in seven groups were screened in Study Group 1 (Significant Impact Potential, adverse or beneficial) (See Figure 1.5). These include (listed alphabetically):

Installations 34,86	Aberdeen Proving Ground (Aberdeen and Edgewood Areas)
Installation 80	Harry Diamond Lab - Blossom Point
Installation 36	Letterkenny Army Depot
Installation 15	Naval Air Station - Oceana

* Note: The term "significant", as used in this study, is a relative expression used to compare potential impact levels on water quality between the 66 DoD installations. The term is not intended to signify the presence of a "statistically significant" impact, as data to show this are generally not available.

Installation 5	Naval Ordnance Station - Indian Head
Installation 23	Naval Shipyard - Norfolk
Installations 17, 18,19,20,21	Sewells Point Navy Complex (Naval Station, Naval Air Station, Naval Rework Facility, Public Works Center, Naval Supply Center)

Similarly, twenty-five installations in twenty-four groups were preliminarily placed in Study Group 2 (Poorly Defined but Likely Significant Impact Potential) (See Figure 1.5). These include (listed alphabetically):

Installation 30	Allegany Ballistics Lab
Installation 52	Andrews Air Force Base
Installation 77	Brandywine Receiver & Housing Annex
Installation 14	David W. Taylor NSRDC - Annapolis
Installation 13	David W. Taylor NSRDC - Carderock
Installation 62	Defense General Supply Center - Richmond
Installation 47	Fort A.P. Hill
Installation 48	Fort Belvoir
Installation 38	Fort George G. Meade
Installation 49	Fort Eustis
Installation 55	Langley Air Force Base
Installations 7	Naval Air Station/Naval Air Test Center-Patuxent
Installation 16	Naval Amphibious Base - Little Creek
Installation 3	Naval Station - Annapolis
Installation 27	Naval Supply Center - Cheatham Annex
Installation 83	Naval Supply Center - Yorktown
Installation 22	Naval Supply Center - Craney Island
Installation 2	Naval Surface Weapons Center - Dahlgren
Installation 4	Naval Surface Weapons Center - White Oak
Installation 26	Naval Weapons Station - Yorktown
Installation 65	Navy Ships Parts Control Center - Mechanicsburg
Installation 1	U.S. Marine Corps - Quantico
Installation 10	U.S. Naval Academy
Installation 41	Vint Hill Farms Station

The above installations (37 total), shown in Figure 1.5, received more detailed evaluation in Phases II and III of this study. The remaining 29 installations did not receive detailed study; however, the findings for these installations were incorporated into the study recommendations at the conclusion of Phase III.

1.4.2 Phase II

Phase II was completed in February, 1987. In Phase II, Tetra Tech developed a detailed assessment methodology to define the likely character and extent of an installation's impact on water quality and living resources in the immediate vicinity of the installation, the tributary(s) to the Bay, and the Chesapeake Bay proper. The methodology utilizes available data and information to quantify, where possible, the impacts of an installation on water quality in terms of: 1) conventional pollutants (nutrient, coliform and BOD loadings), 2) output of toxic and

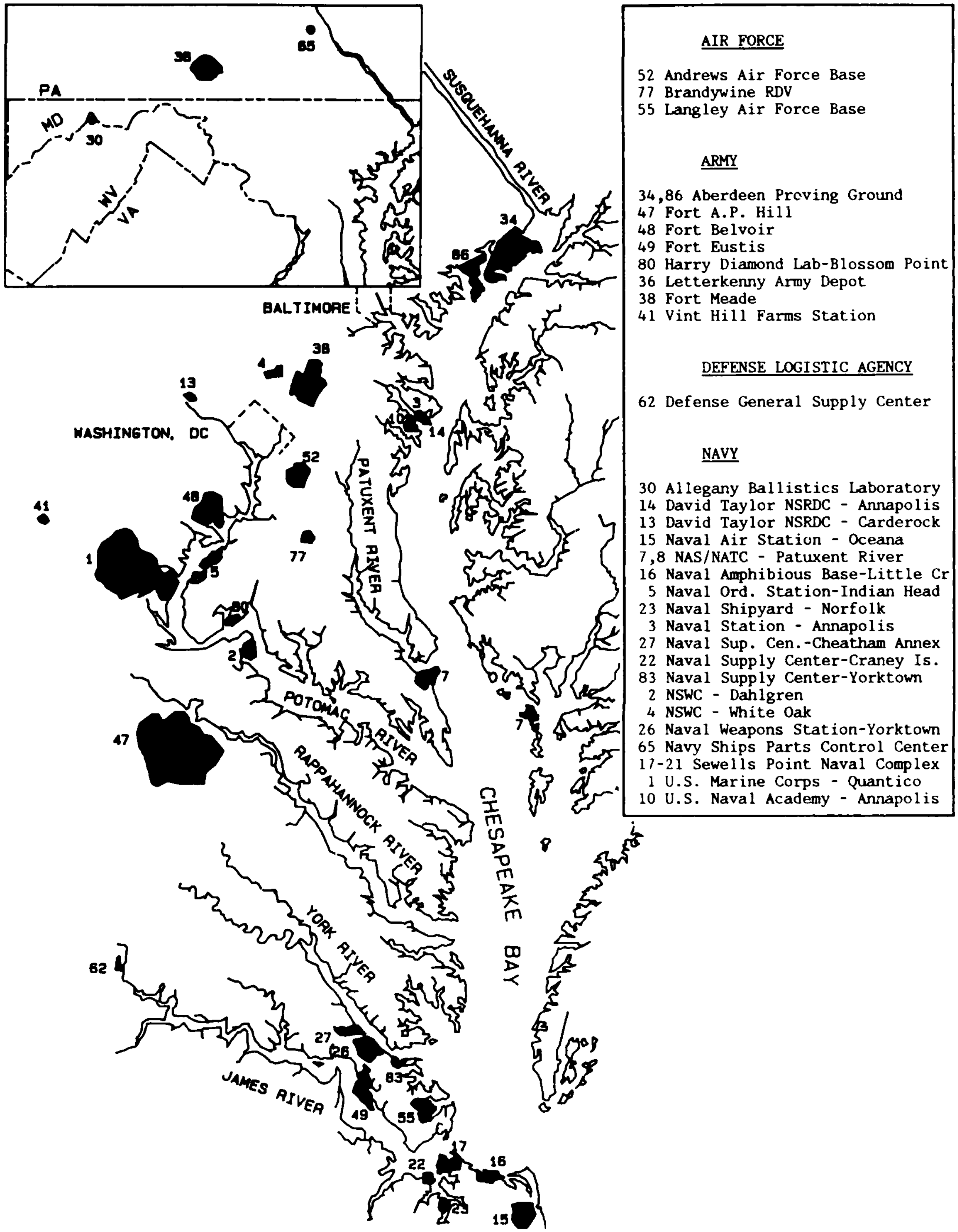


Figure 1.5 Location of the 37 Installations Addressed in Phases II and III. [Note: numbers 7, 17, and 34 represent installation complexes.]

hazardous substances, 3) contribution of sediment and turbidity, 4) effects on benthic sediment quality, and 5) effects on benthic biota and on planktonic populations. Where quantification of water quality impacts was not possible, potential impacts were qualitatively addressed through an updating of the Phase I screening exercise. Phase II also included testing of the methodology on six selected installations in order to evaluate its effectiveness. The six test installations included Andrews Air Force Base (USAF), Fort Eustis (USA), Naval Surface Weapons Center - Dahlgren (USN), Letterkenny Army Depot (USA), Marine Corps Development and Education Center - Quantico (USN), and Naval Ordnance Station - Indian Head (USN). A description of the assessment methodology and the results of the six test applications are presented in the Phase II report (Tetra Tech, 1987).

1.4.3 Phase III

In Phase III the methodology developed and refined in Phase II has been applied to the remaining 31 installations and a summary has been prepared describing DoD impacts by Service, installation, region and/or tributaries, and Bay-wide. The Phase III report also includes recommendations for all 66 installations which could be implemented at specific locations to improve water quality and living resources of the Bay. To aid DoD in developing an implementation strategy for the recommended actions, general cost estimates have been prepared for each major program recommendation. The general cost estimates have been summarized from cost estimates assigned to each installation-specific recommendation. In addition, a qualitative description of the benefits to water quality likely to result from the implementation of each recommendation has been prepared for DoD's use in evaluating beneficial effects of program implementation and prioritization of specific actions.

Other activities in Phase III have involved the preparation of generic guidance for point source, nonpoint source and groundwater monitoring programs at a typical installation. Implementation of these programs, where necessary, would provide DoD with useful information on the impact potential of an installation on local receiving waters.

1.5 PHASE III REPORT ORGANIZATION

This section serves as a guide to the Phase III report. The Phase III report is presented in two volumes. Volume I (Summary) is a brief overview of the highlights and major findings of the study. Volume II (Overall Approach, Findings and Recommendations) is an expanded overview and includes a description of the project data base, the installation assessment methodology, and summaries of all 66 installation assessments organized by Bay region or tributary. Also included in Volume II is a final screening of all 66 installations, a summary of DoD impacts by service, region and Bay-wide, and a presentation of findings and recommendations for all installations, including cost estimates and expected benefits for each recommendation.

1.6 CITATIONS

Tetra Tech, Inc., 1986. Water Quality Assessment of DoD Installations/ Facilities in the Chesapeake Bay Region, Phase I Report - Data Gathering and Installation Screening. U.S. Army Corps of Engineers, Baltimore District Contract DACA 31-85-C-0168, October, 1986.

Tetra Tech, Inc., 1987. Water Quality Assessment of DoD Installations/ Facilities in the Chesapeake Bay Region, Phase II Report - Development and Testing of Installation Assessment Methodology. U.S. Army Corps of Engineers, Baltimore District Contract DACA 31-85-C-0168, June, 1987.

2.0 SUMMARY OF PROJECT DATA

2.1 INTRODUCTION

A major goal of this study was to establish data collection procedures and to compile the available information into a usable data base. The scope of the study was limited to the gathering of readily available information in either raw or summarized form. Since no field work was performed to supplement the available information, information was gathered from as many known sources as time allowed.

In an attempt to provide a comprehensive and unbiased collection of information the data gathering responsibilities were divided between two separate teams. One team identified and collected data from DoD sources including reports, correspondence, site visits, and personal communications with DoD personnel. This information was primarily concerned with onsite activities, i.e., installation missions, specific hazards to water quality that may be generated, responses to specific water quality problems, and mitigation efforts. The second information gathering team identified and collected data from non-DoD sources. This information was collected from Federal, state, and local government agencies which deal with environmental regulation, and from academic and environmental groups which may have specific interests in the local aquatic environment. The information was intended to allow an assessment of an installation's effect on the surrounding environment.

2.2 DOD DATA SOURCES

DoD data sources were identified through interviews systematically held with DoD personnel responsible for environmental matters at each command level. Types of water quality information available at given levels were identified, and meetings with personnel at the next lower command level were arranged.

During the meetings the study was briefly discussed and a data checklist was presented to aid in identifying data sources. A list of the agencies contacted follows.

SERVICE	AGENCY
Department of Defense	Defense Environmental Leadership Project
Defense Logistics Agency	Headquarters (DLA-WS/DEPO)
U.S. Air Force	Headquarters (LEEVP)

U.S. Army	Headquarters (DAEN-ZCE) HQ Army Environmental Hygiene Agency (AEHA) HQ Toxic and Hazardous Materials Agency (THAMA) HQ Army Materiel Command (AMCEN-A) HQ Training and Doctrine Command (ATEN-FN) HQ Information Systems Command (CC-ENGR-CC) HQ Forces Command (AFEN-MSE) HQ Health Services Command (HSCL-P) HQ Intelligence and Security Command (IALOG-IF)
U.S. Navy	Naval Facilities Engineering Command (NAVFACENGCOM) (Code 1121E) Chesapeake Division NAVFACENGCOM (CHESDIVNAVFACENGCOM) (Code 114) Atlantic Division NAVFACENGCOM (LANTDIVNAVFACENGCOM) (Code 114) Naval Supply Systems Command (NSSC Code 06X) Naval Energy and Env. Sup. Act. (NEESA)

In addition to the above list, all installations listed in Figure 1.2 were visited. The environmental coordinators at the installations were interviewed and the bases were toured in order to gather additional information not readily available in existing reports. In many cases the installation environmental coordinator was able to supply information on studies performed on local waters by non-DoD researchers that was used as a cross reference to studies already inventoried or as insight into ongoing or unpublished studies.

The information was grouped into four categories.

1. On-site raw monitoring data
2. Reports generated by independent agencies
3. Reports generated by the DoD installation
4. Permit applications

The following sections address each of these categories in more detail and briefly describe the data sources in each.

2.2.1 On-site Raw Monitoring Data

On-site raw monitoring data includes information which has been gathered by installation personnel or others in response to a request by another agency or to assess an ongoing program. Examples of the types of raw data that were available at some installations follow:

Discharge Monitoring Reports (DMR's) - These data consist of information gathered by base personnel at the installation's discharge points in order to comply with requirements specified in the National Pollution Discharge Elimination System (NPDES) Permits. The reports contain

laboratory analyses of water samples taken at a specified interval and address certain prearranged constituents. These reports are usually available at the installation as well as at the sub-command or command level.

Operating Logs - Installation sewage treatment plants (STP's), industrial wastewater treatment plants (IWTP's), water treatment plants (WTP's) and other treatment facilities have requirements for monitoring effluent on a regular basis. These logs often contain effluent volume data and chemical analyses which document compliance.

Landfill Groundwater Analysis Logs - In cases where a landfill has been designated as presenting a hazard to groundwater, monitoring wells have been sunk in the vicinity of the landfill in order to determine the amount of contaminant migration. These projects tend to be of short duration and are not performed for off-base areas.

Water Quality Studies - Occasionally, an installation monitors surface water quality on the base in response to requests by other agencies. This type of data is often sporadic and of short duration.

2.2.2 Reports Generated by Independent Agencies

Ongoing programs by DoD are instrumental in creating required reports on installations. These reports generally address specific subjects and contain much background information useful in making water quality assessments.

Installation Restoration Plan (IRP) Studies - In response to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), also known as "Superfund", the services have implemented comprehensive programs to deal with the detection and remediation of groundwater contaminated by abandoned landfills. The Army's and Air Force's Installation Restoration Programs (IRP) and the Navy's Navy Assessment and Control of Installation Pollution (NACIP) Program generate extensive assessments of an installation's contributions to groundwater contamination in the form of a report. The reports also have a great deal of pertinent background and historical information. The studies are generally performed by USATHAMA for the Army and by NEESA for the Navy, while the Air Force studies are performed by the USAF Occupational and Environmental Health Laboratory (OEHL).

Engineering and Environmental Support Programs - Each of the services has engineering and environmental support programs which can perform a variety of support functions, from analyses of transformer oils for PCB's to general environmental audits and environmental impact statements. The organizations are AEHA for the Army, OEHL for the Air Force and NEESA for the Navy. The reports generated by these agencies are usually available from the installation or from the agency itself.

2.2.3 **Reports Generated by the Installation**

Self generated reports at the installation level may respond to specific requests from a command level or may meet the requirements of a program imposed from another agency. An installation may generate a report on its own initiative to compete for environmental awards which are open to all the services. The usefulness of self-generated reports to this study varies, however, they do identify areas of environmental concern.

Master Plan - The plans generated by the installation planning department are useful in gathering data about specific land use and construction projections. The master plan gives information about the base population, its mission and other pertinent information.

Natural Resource Plan - The installations' Natural Resource offices have, in some instances, implemented progressive resource management programs which may have either a positive or negative effect on water quality.

Spill Prevention Control and Countermeasures (SPCC) Plan - The SPCC specifies the actions that should be taken to prevent or to respond to an oil spill and is usually specific about the base's risk of oil spills. It is required that the SPCC Plan be updated every three years.

Oil and Hazardous Materials Spill Contingency Plan - This report is usually specific about the amounts and locations of hazardous material storage points and provides information on the potential hazards to water quality.

Stormwater Management Plan - On occasion an installation will formulate a stormwater management plan which addresses the disposition and disposal of stormwater from the base.

2.2.4 **Permit Applications**

A number of detailed permit applications, which can yield water quality information, are generated in order for a base to meet discharge limitations. The installations are required to have copies of their permits on site. Although not always available at the installation, the issuing agencies or the major commands were generally able to provide copies when the installations could not.

NPDES Permit Applications - The installation's permit to discharge water into the nearby surface waters contains water quality information including the point(s) of discharge and the constituents found in the discharge water.

Resource Conservation and Recovery Act (RCRA) Permit Applications - The storage of hazardous wastes on base requires an installation to submit applications for hazardous waste storage facilities. These applications

contain a great deal of background information concerning the generation and storage requirements of hazardous wastes.

Sanitary Landfill Permit Applications - The states require permits prior to dumping certain types of refuse in a landfill. The applications contain information about the uses of the landfill, its location, and identify water quality hazards associated with the landfill.

2.3 NON-DOD DATA SOURCES

Non-DoD data sources were identified in a systematic survey of individuals and agencies relying on two networks of contacts. First, informal contacts were made with researchers and professionals working in water quality investigations in the Chesapeake Bay region. Some of these contacts were made by phone, most were made by personal visit. During each visit the project was briefly described and relevant materials and additional contacts were requested. Second, formal contacts were made with heads in local government agencies through letters sent advising them of the project and requesting their support. These persons generally responded with a list of additional contacts within their offices and expressions of interest and support for the project. Meetings were then arranged and less formal contacts were made with those agencies.

The following agencies and institutions were contacted during the study:

Federal Government Agencies

Environmental Protection Agency (EPA) Headquarters-Permit Compliance System (PCS)

EPA Region III

EPA Region III, Chesapeake Bay Liaison Office

Smithsonian Institution-Center for Environmental and Estuarine Studies

U.S. Army Corps of Engineers, Baltimore District (NAB)

U.S. Army Corps of Engineers, Norfolk District (NAN)

U.S. Fish and Wildlife Service, Annapolis, Md. (FWS)

U.S. Geological Survey (USGS)

State Government Agencies

Chesapeake Bay Critical Areas Commission

Maryland Department of Natural Resources (DNR)

Maryland Department of Health and Mental Hygiene, Office of Environmental Programs (OEP)

Maryland Geological Survey (MGS)

Pennsylvania Department of Environmental Resources (DER)

Virginia State Water Control Board (SWCB)

Virginia Marine Resources Commission (MRC)

Virginia Commission of Game & Inland Fisheries

Virginia Department of Health

Virginia Nature Conservancy

Washington Dept. of Consumer & Regulatory Affairs

Regional Commissions

Chesapeake Bay Commission

Potomac River Fisheries Commission

Susquehanna River Basin Commission

Academic Institutions

Academy of Natural Sciences of Philadelphia-Benedict Maryland Lab

Chesapeake Research Consortium (CRC)

Environmental Center Anne Arundel Community College

Johns Hopkins Chesapeake Bay Institute (CBI)

Old Dominion University (ODU)

University of Maryland-Center for Environmental and Estuarine Studies (CEES)

Virginia Institute of Marine Sciences (VIMS)

Others

National Wildlife Federation

Science and Environmental Associates

2.3.1 **Additional Data Sources for Phase I Site Evaluations and Screening**

Data gathered during Phase I were primarily atlases and summary reports describing environmental conditions. This allowed the screening of installations without the detail of information which would be necessary for the detailed assessments scheduled for Phases II and III. Several relevant datasets were also selected for acquisition during Phase I. The following sections describe those reports, atlases and data sets. A list of citations referencing these reports is included in section 2.5.

2.3.1.1 **Coastal Habitats**. Eight major map sets which contain coastal habitat information for Phase I of the study were acquired. The map sets are:

- National Wetland Inventory Maps (USFWS),
- Virginia Tidal Marsh Inventory (VIMS),
- Shoreline Situation Reports (VIMS),
- Offshore Pipeline Corridor and Landfalls on Coastal Virginia (VIMS),
- Maryland Coastal Wetlands (MD DNR), and
- Environmental Sensitivity Index Maps and SAV Maps (Orth 1984).

Except for the Maryland Coastal Wetland maps, all the map sets are in atlases. In several instances noted below, accompanying documents were provided.

The Maryland Coastal Wetland Maps are on 42 inch square mylars at 1:24,000 scale. An accompanying report (McCormick and Soames, 1982) describes the methods used to create the maps and presents the results of investigations on productivity, diversity, wildlife food value and tabular listings of acreage. The Maryland system delineates 35 types of wetlands. The maps outline wetland areas 0.25 acres or larger. The map series was photographed in 1971 and 1972. Additional photographs were taken in 1976 to fill in data gaps.

The National Wetland Inventory Maps are based on an inventory conducted by the USFWS, Division of Habitat Resources. USFWS identified habitat types by aerial photography which were then classified according to Cowardin, et al., (1979). The aerial photography was taken during the ten year period from 1973 to 1983. The original maps are 1:24,000 (USGS Quad Sheet) scale and copies are available from Maryland DNR. Reductions of all Chesapeake Bay maps are in four draft atlases or in the form of photographic slides.

The Virginia Tidal Marsh Inventory is a series of reports compiled by the Wetlands Research Section, VIMS. The reports locate more than 20 distinct

marsh community types and document marsh acreage on 1:24000 scale maps. There is a separate report for each county published between 1972 and 1981. The information summarized within the reports is from aerial photographs supplied by the USGS. No citation is provided for the photographs. The Shoreline Situation Reports map the Virginia Coastline from a planning perspective. The maps classify coastal areas into usage zones such as residential, commercial, government, recreational or preserved. Water quality ratings are based upon the Virginia Bureau of Shellfish Sanitation coliform surveys.

Natural and man-made shoreline structures are represented on the maps. The maps indicate erosion rates and non-specific marsh types (e.g. beach, fringe, embayed, etc.). A short summary accompanies each map which lists key features and gives citations for all source maps and photographs.

The Offshore Pipeline Corridor and Landfalls On Coastal Virginia Study partially fulfills the requirements of section 305(b) of the Clean Water Act. The study focuses on planning the location of oil and gas facilities with consideration of their possible effects on coastal resources. An extensive map series outlines areas' sensitivity to oil and gas products. Separate maps show resources such as spawning grounds, bald eagle nesting areas, and commercial maritime species.

The Environmental Sensitivity Index maps are an extension of the Corridor Study in which information was remapped onto full color 7.5 minute quadrangle sheets.

2.3.1.2 **Submerged Aquatic Vegetation (SAV).** SAV occurrence is summarized by Orth and Moore (1984). Their report is a summary of aerial photography conducted during 1984 and supported in ground surveys by USGS, VIMS, and Maryland DNR. It identifies SAV beds, and estimates the percent coverage. The beds are mapped onto 7.5 minute quad sheets (scale 1:24,000). The report includes reproductions of the maps. The report also provides comparisons with conditions existing in 1978 and statistics on total abundance.

Separate reports detail ground surveys conducted by USGS in the Potomac. The earliest report (Carter 1983) identifies the SAV species and relates their occurrence to several physical factors. The survey began in 1978 and ended in 1981. Observations of increased SAV occurrence prompted additional similar studies in 1983 (Carter et al, 1985 and Rybicki et al, 1985). Rybicki's work focuses on the rapid spread of Hydrilla. The report discusses growth rates, distribution and competitive effects of this species on other forms of SAV.

2.3.1.3 **Potomac Atlas.** The Potomac estuary is further summarized in the Environmental Atlas of the Potomac Estuary of the Power Plant Siting Program of Maryland DNR. The volume is an ecological review of the estuary. It maps ecologically important physical and chemical data (i.e., salinity, temperature, sediments, topography, etc.) and the distribution, abundance,

spawning areas, and migration patterns for many taxa. The atlas also includes information on phytoplankton and benthic invertebrates.

2.3.1.4 Section 305 (b) Reports. Section 305(b) (of the Federal Water Pollution Control Act) reports describe water quality conditions in Virginia and Maryland. These reports are prepared by the Office of Environmental Programs in Maryland and the State Water Control Board in Virginia. Section 305(b) requires the States to provide a report on the water quality of the State. The States are also required to describe steps undertaken or proposed to comply with the Clean Water Act. The reports describe point and non point pollution sources, existing water quality and problem areas for each State. A Priority Water Bodies List accompanies these reports. The list ranks waters with significant water quality problems and establishes goals for meeting the Clean Water Act.

The Water Resources Planning Board of the Washington Council of Governments publishes a similar report for the metropolitan Potomac and Anacostia Rivers which assesses existing water quality and describes monitoring programs and efforts to control pollution.

2.3.1.5 Endangered Species. The Maryland Natural Heritage Program summarized the extent of endangered and threatened species in the State. The summary is published in the proceedings of a conference held at Towson State University in 1981 (Norden et al, 1984). The papers presented at that meeting were updated and collected in the volume released in 1984. The report covers the status of known endangered and threatened species, however, many important taxa are not documented.

The USFWS provided county maps of endangered species in both Virginia and Maryland. The Virginia Nature Conservancy and the Maryland Natural Heritage Program are providing site-specific information.

2.3.1.6 Fisheries. Bonzak and Jones (1985) present Bay wide commerical and recreational fishery statistics including an atlas of graphs with separate graphs for each combination of area, species, and catch method. The graphs show catch statistics reported over the available time period. In many instances, the data extend back to the 1930s.

2.3.1.7 Shellfish Beds. Shellfish bed maps were obtained from the Marine Resources Commission in Virginia and the Waterway Improvement Division of MD DNR. The Maryland maps are based on the Maryland Bay Bottom Survey (1980 to 1982) and show natural oyster bars, clam lines, and leased areas. The maps include the total acreage for each oyster bar. The maps are 1:20,000 scale. Two large scale (1:200,000) maps cover Virginia waters. The data used to prepare the Virginia maps are over 10 years old. The maps show the Baylor and leased grounds by species. Individual maps of each bar are available.

2.3.1.8 **Avifauna.** As part of their Biological Services Program, the USFWS inventoried nesting waterbird colonies along the Atlantic Coast in 1976 and 1978. Erwin (1979), and Korschgen and Erwin (1977) outline the colonies and describe their species composition and densities. A similar study (Osborne and Custer, 1978) focused on herons, egrets, and other associated species based upon data gathered in 1975 and 1976.

Winter waterfowl distribution and abundance have been surveyed each year in Maryland and Virginia since 1954. Steiner (1984) depicts population trends for individual species. All of the data used to compile the report is computerized and available from the USFWS. The Maryland and Washington, D.C. Breeding Bird Atlas Project is a continuing cooperative research effort between the MD DNR Forest, Park and Wildlife Service, the Maryland Ornithological Society and other local conservation groups. The project divides the 7.5 minute quadrangle sheets for Maryland and the District of Columbia into six equal blocks. The project goal is to identify a minimum of 70 species per block. Surveys have been completed for approximately three quarters of the blocks. Although no reports are yet published, existing data on this project are available.

2.4 DATA BASE DESCRIPTION

2.4.1 General

The DoD Chesapeake Bay data base was designed to hold on-site and vicinity water quality data for use in the evaluation/assessment of DoD installations. The goal was to identify and acquire readily available water quality data which describe the Bay's health in the vicinity of the DoD installations as well as point source data which describe the loadings into the Bay's drainage systems and permit compliance of DoD and non-DoD dischargers. DoD and non-DoD data sources have previously been described in the Phase I report (Tetra Tech, 1986).

The data base was developed in two phases. In Phase I, 27 government agencies and research institutions were contacted for the purpose of identifying relevant data sets. This data set search was limited to completed, well-documented studies. In Phase II, the data sets were acquired, converted into SAS format and documented. SAS was chosen as the computer storage format because it is the format used by the EPA Chesapeake Bay Program. Variable names, data types, and parameter units were standardized to Chesapeake Bay Program conventions whenever possible. Not all data sets were acquired in a computer stored format. Some data could only be retrieved in hard copy format as they were not entered into an appropriate computer file. Study reports and other data set documentation were stored in a project library which includes all DoD and non-DoD literature, reports, and other information used in the overall assessment methodology. The library was entered into a DBASE III+ bibliographic program file designed to allow easy expansion, viewing, and updating of all on-site and vicinity material.

The data base resides on three computers. Small (less than 3,000 observations) data sets are stored on microcomputer diskettes. Medium sized data sets are stored on the Chesapeake Bay Program's VAX 11/780 computer. Large data sets are stored on the National Computer Center's IBM 3090 computer. Data sets on all three computers are stored in SAS format. Complete information on accessing the files on the above computers, points of contacts, available documentation, and data set structure can be found in the project data base report (SCI, 1986).

2.4.2 Data Set Descriptions

Data set descriptions for each of the non-DoD data sets used in the assessment methodology are given in the following paragraphs.

Joint EPA, Maryland, Washington D.C., and Virginia Water Quality Monitoring Program. This program monitors water quality at stations located throughout Chesapeake Bay below the Fall Line. Water quality measurements are taken at 22 mainstem and 55 tributary stations at least monthly. Stations were selceted which would provide a characterization of water quality within the segments identified by the Chesapeake Bay Program. Segment boundaries delineate isohalines (areas of approximately equal salinity) and circulation patterns. Stations are also selected with regard to severe anthropogenic sources of pollution, important living resource habitats, riverine-estuarine transition zones, and established sampling locations with long historical data records. Both surface and bottom samples are collected at each station. At stations where stratification occurs, additional samples are collected above and below the pycnocline.

Chesapeake Bay Program Historical Water Quality. This program monitors water quality at stations located throughout Chesapeake Bay. This data set is part of the data base used by the Chesapeake Bay Program to characterize water quality in the Bay. Results of this characterization ultimately led to joint resolutions between EPA and DoD as well as other Federal and State agencies to clean-up the Bay. The data set includes data from many studies and sampling programs. All water quality variables have been standardized with respect to SAS names and units of measurements. A variable to indicate the original source of each observation is included.

Metropolitan Washington Council of Governments Potomac Data Base. This program is maintained as part of the Regional Potomac Monitoring Program and monitors water quality at stations located in the Potomac River and tributaries between Point of Rocks, Maryland and Maryland Point. Various State and local governments operate and fund the program which monitors approximately 50 stations at least monthly. Samples are analyzed by the collecting agency for a number of water quality parameters. Because samples are collected and analyzed by a number of different agencies, not all parameters are included with each SAS data set. In response to the 1983 algae bloom, weekly sampling from June through September was instituted at a core network of six stations located between Piscataway and Quantico where the highest concentration of nuisance algae occurred in the river during 1983.

Long-term Benthic Monitoring for the Maryland Portion of Chesapeake Bay. This program monitors water quality at stations located in the Maryland portion of the Bay including the mainstem, Patapsco, West, Patuxent, Potomac Rivers and eastern shore tributaries. This is a large data set that includes Maryland Power Plant Siting Program benthic studies carried out between 1971 and 1984. Beginning in 1984, Maryland OEP and the Power Plant Siting Program combined their benthic monitoring programs and spawned the "Long Term Benthic Monitoring Program". In this new program, benthic biota are sampled 10 times each year at 70 stations. Physical and chemical parameters, including sediment type and near-bottom water quality, are measured when benthic samples are collected. Temperature, conductivity, salinity, dissolved oxygen and pH of the water column are also measured. Benthic invertebrates are identified to the lowest taxonomic level and counted. Biomass of the most abundant species is determined.

STORET. This program monitors water quality at stations located throughout the Chesapeake Bay drainage basin, including sampling locations above the Fall Line. STORET is the Environmental Protection Agency's Computer system for the storage and retrieval of nationwide water quality data. The data sets retrieved from STORET for this project contain data collected by various Federal, State, and inter-state agencies responsible for monitoring water quality.

Maryland Benthic Macroinvertebrate Program. This program monitors water quality at stations located in the Bush, Gunpowder, Patapsco, Patuxent, Potomac, Magothy, Severn, South, West, and Rhode river basins. This is Maryland's primary biomonitoring program. It provides water quality information on many streams not otherwise sampled. Benthic macroinvertebrates are collected between June and August using a Surber sampler or multiplate sampling devices (placed in the field for about six weeks. Water column data collected include dissolved oxygen, pH, temperature, and salinity measurements. Benthic organisms are identified to the lowest possible taxonomic level. Each benthic macroinvertebrate station is visited at least biannually. Potomac River stations are sampled annually.

Maryland Shellfish Sanitation Program - Coliform Data. This program monitors water quality at stations located in the mainstem and tributaries of the Severn, Patuxent, and Potomac Rivers. The Maryland Office of Environmental Programs routinely monitors coliform bacteria in all class II (shellfish harvesting) waters. Approximately 1600 stations are in the Shellfish Sanitation Program network. Selected stations in this network are sampled monthly for temperature, salinity, and dissolved oxygen. Coliform abundance is estimated at least monthly at all stations. In addition, shellfish tissue (shellstock) is regularly sampled from selected stations in each growing area and fecal coliform bacteria are enumerated. Harvesting from areas in which the shellstock fecal coliform bacterial levels exceed the market standard may be banned.

Environmental Monitoring of the Hart and Miller Islands Containment Facility. This program monitors water quality at stations located in the vicinity of Hart and Miller Islands. The program is designed to collect data necessary for determining negative impacts on the habitat surrounding the containment facility. The value of this data set is its location down-estuary from Aberdeen Proving Ground. The data set includes data from a two year baseline investigation (August 1981 - August 1983). Construction of the containment facility was started in December 1982. The third and subsequent years (August 1983 - 1985) monitoring programs were designed to provide information on environmental impacts from the operation of the containment facility. The data set includes information on benthos, fish populations, and sediment studies.

Chesapeake Bay Program Point Source Loadings for Major Dischargers. This program monitors water quality at stations located Bay-wide. This data set contains the Chesapeake Bay Program's most current estimates of nutrient loadings for major discharges located below the Fall Line. The Chesapeake Bay Program generated this information to assist in the development of pollution abatement recommendations, and for the calibration of water quality models. The information was developed by retrieving information on effluent flows and pollutant concentrations from the Permit Compliance System (PCS) and other centralized data bases. The data consist of montnly average flows and effluent concentrations for the summer months of 1984 and 1985. These time periods were required to calibrate the Chesapeake Bay Program's water quality model.

Permit Compliance System. This program monitors water quality at stations located Bay-wide. The Permit Compliance System (PCS) was developed by the Environmental Protection Agency to provide automated storage and retrieval of information on NPDES permitted dischargers. NPDES permits for Federal facilities in the Chesapeake Bay region are administered by EPA Region III. Most Federal facilities studied in this project have had or now have at least one NPDES permit. This data set consists of information limited to Federal facilities. It was obtained with the help of Region III staff. The data set includes information on the facility (location, mailing address, etc.), permit limits (maximum and average permitted effluent concentrations), pipe schedule (location and limits for each point of discharge), and the occurrence of measurement violation(s).

Integrated Facilities Data Base. This water quality monitoring program includes stations located Bay-wide. This data set contains basic information on NPDES dischargers in the Chesapeake Bay region. For each NPDES permit number, data are available on the total effluent flow, flow broken down by processes, the name of the receiving water, the facility name and State, the latitude and longitude of the facility, the USGS hydrologic cataloging unit number, and the standard industrial code classification. This data set is useful for enumerating dischargers in a given region and for locating them on a map.

2.4.3 Summary

Ambient water quality conditions of several of the installations from the above data sets were available for the assessment of the relative impact of the point and nonpoint source contributions from the installation. The ambient water quality conditions were evaluated using the Federal and State water quality guidelines and/or data from the literature. The data in the above water quality monitoring programs were subsetted for the local water quality conditions at each individual installation. Summaries of local water quality conditions were compiled with the available data for a period from 1980 to the present. Although the data sets frequently had hundreds of variables listed, the amount of actual data available for evaluation of a specific installation varied considerably. Physical data and conventional pollutants data were the most frequently occurring types of data while toxics and biological species distribution data were least frequently found in the data sets. The data also lacked adequate spatial and temporal coverage for testing the hypothesis that an installation was responsible for the local water quality conditions observed. This usually resulted from the fact that stations were not located close enough or along a gradient corresponding to a point or nonpoint pollutant source on the installation and therefore the data was not amenable to development of cause and effect relationships, or statistically valid conclusions. This problem was further complicated by the fact that there are often non-DoD point and nonpoint pollutant sources in the same area making it virtually impossible, with existing station coverage, to separate the relative impacts of the DoD and non-DoD sources on local water quality conditions.

2.5 CITATIONS

Bonzak, C.F. and P.W. Jones. 1985. Assessment of the Population Dynamics of Important Commericial or Recreational Fish of Chesapeake Bay: An Atlas of Commercial Fishery Statistics in Chesapeake Bay 1929-1980. Maryland Department of Natural Resources, Tidewater Administration Tidal Fisheries Division. Technical Memorandum No. 5.

Carter, V., P.T. Gammon, and N.C. Bartow. 1983. Submersed Aquatic Plants of the Tidal Potomac River, U. S. Geological Survey Bulletin 1543.

Carter, V., N.B. Rybicki, R.T. Anderson, T.J. Trombley, and G.L. Zynjuk. 1985. Data on the distribution and abundance of submersed aquatic vegetation in the tidal Potomac River and transition zone of the Potomac estuary, Maryland, Virginia and the District of Columbia, 1983 and 1984. U.S. Geological Survey, Reston, VA. Open-File Report 85-82. 61 pages.

Cowardin, L.M., V. Carter, F.C. Golet and E.T. La Roe. 1977. Classification of Wetlands and Deepwater Habitats of the United States. U.S. Fish and Wildlife Service. FWS/OBS-79/31. 103 pp.

Erwin, M.R. 1979. Coastal Waterbird Colonies: Cape Elizabeth, Maine to Virginia. U.S. Fish and Wildlife Service. FWS/OBS-79/10.

Korschgen, C.E. and R.M. Erwin. 1979. Coastal Waterbird Colonies: Maine to Virginia, 1977. An Atlas Showing Colony Locations and Species Composition. U.S. Fish and Wildlife Service. FWS/OBS-79/08.

McCormick, J. and H.A. Somes. 1982. The Coastal Wetlands of Maryland. Maryland Department of Natural Resources Coastal Zone Management Program. 243 pp.

Norden, A.W., Forester, D.C. and G.H. Fenwick (edit.) 1984. Threatened and Endangered Plants and Animals of Maryland 1984. Maryland Natural Heritage Program, Maryland Department of Natural Resources. 84-I.

Orth, R.J. and K.A. Moore. 1984. Distribution of Submerged Aquatic Vegetation in the Chesapeake Bay: An Historical Perspective. Estuaries 7:531-540.

Osborn, R.G. and T.W. Custer. 1978. Herons and Their Allies: Atlas of Atlantic Coast Colonies, 1975 and 1976. Biological Services Program, U.S. Fish and Wildlife Service. Washington, D.C. 211 pp.

Rybicki, N.B., V. Carter, R.T. Anderson and T.J. Trombley. 1985. Hydrilla verticullata in the tidal Potomac River, Maryland, Virginia, and the District of Columbia, 1983 and 1984. U.S. Geological Survey, Reston, VA. Open-File Report. 85-77. 26 pp.

Steiner, A.J. 1984. Mid-Winter Waterfowl Inventory Atlantic Flyway 1954-1984 Trend Analysis USFWS Region 5.

3.0 INSTALLATION ASSESSMENT METHODOLOGY

3.1 GENERAL APPROACH

The Phase I preliminary screening system served as an initial assessment of the impact potential of the 66 DoD installations on water quality and living resources of Chesapeake Bay and its tributaries. In Phase I, most of the analysis was qualitative and was based on the "potential" for environmental impacts as opposed to known or measured "actual" impacts. This approach proved useful in identifying 29 installations which clearly do not have a significant impact potential, and thus could be eliminated from further analysis in Phases II and III of this study. For the remaining 37 installations estimated to have a significant* impact potential, a more quantitative assessment was required to verify suspected or known pollutant impacts and to identify and recommend specific practices or programs that could be used to restore and/or protect water quality and living resources of the Bay.

In Phase II, a detailed installation assessment methodology was developed and tested on six installations. The results of the test applications are presented in the Phase II report (Tetra Tech, 1987). Based on the test applications, the methodology was judged satisfactory for application to the remaining 31 installations in Phase III. Summaries of the installation assessments are presented in Chapter 4.0 of this report. The remainder of this chapter presents a brief description of the installation assessment methodology.

The design of both the Phase I screening and the installation assessment methodology is based on the same major areas of concern as identified in the EPA Chesapeake Bay Program (CBP). The CBP developed a number of Bay management recommendations based on extensive research which correlates degradation of the Bay's aquatic resources with various pollutant sources. A brief summary of the CBP's major findings is presented below.

Nutrients - Increased nutrient levels in the Bay and the corresponding decrease in dissolved oxygen through undesirable algal production has had detrimental effects on submerged aquatic vegetation (SAV), fisheries, and shellfish resources throughout the Bay. Both point and nonpoint sources contribute to nutrient loadings. Point sources for nutrients consist primarily of municipal sewage treatment plants and certain industrial plants. Point sources generally contribute the majority of the phosphorous loading to the Bay (61 percent), and are concentrated primarily in the

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* Note: The term "significant", as used in this study, is a relative expression used to compare potential impact levels on water quality between the 66 DoD installations. The term is not intended to signify the presence of a "statistically significant" impact, as data to show this are generally not available.

urbanized areas of the western bay tributaries (i.e., Patapsco, Patuxent, Potomac, and James River). Nonpoint sources of nutrients include stormwater runoff from forests, farmlands, and improved lands, groundwater flow, and atmospheric deposition. The nonpoint source runoff from cropland contributes the largest share of the nonpoint source nutrient load to the Bay. Nonpoint sources contribute the majority of the nitrogen loading to the Bay (67 percent). Accounting for both point and nonpoint sources, the Susquehanna, Potomac and James Rivers contribute approximately 78 percent and 70 percent of the Bay-wide nitrogen and phosphorus loadings, respectively. Management recommendations made by the CBP to control nutrient loadings from point sources include upgrading treatment plants for nutrient removal, improving treatment plant maintenance and efficiency, improving monitoring and enforcement of NPDES permit limitations, and implementation of pretreatment programs. Nonpoint source recommendations for controlling nutrient loadings include best management practices (BMPs) for agricultural uses (e.g., soil conservation, runoff control, animal waste management, improved fertilizer application, creation of buffer strips), urban runoff control BMPs (also needed to control sediment, heavy metals, bacteria, and other pollutants), and protection of tidal and non-tidal wetlands which act as nutrient buffers.

Toxics - toxic compounds include metals such as cadmium, copper, and lead; organic chemicals such as polychlorinated biphenyls (PCBs), Kepone, and DDT; and other chemicals like chlorine. These and other toxicants are affecting the Bay's resources especially in urbanized areas. High levels of toxicants can reduce egg production, juvenile survival, and maturation rate and can result in histopathologies such as disease, lesions, and genotypic variation in fish and invertebrates. High levels of toxicants have also been correlated with low species diversity where sensitive species are eliminated leaving communities dominated by a few pollution-tolerant forms. As with nutrients, sources of toxic materials include both point and nonpoint sources. Point sources of toxic compounds include industrial and municipal waste treatment plants, and other industrial effluents such as from power plants. Point sources of toxics appear to be most significant in industrialized areas such as Baltimore and Norfolk. Nonpoint sources primarily include urban and agricultural runoff, air pollution deposits, shore erosion, and maritime activities (e.g., petroleum spills, anti-fouling paints, and illegal bilge pumping). Localized toxic sources from leaking hazardous waste dumpsites or accidental toxicant spills also occur. In general, the Susquehanna, Potomac, and James Rivers are the major sources of metals from soil erosion and agricultural runoff. Effluent from industries and sewage treatment plants, and urban runoff create the greatest concentrations of toxic organic compounds in urbanized areas such as Baltimore, Washington, D.C., and Hampton Roads. Management recommedations made by the CBP to control toxicant loadings from point sources include biomonitoring and chemical analysis of industrial and municipal effluents to identify presence and levels of toxicants, revision of water quality criteria and standards for toxicants, updating of NPDES permits to include toxicant limitations, enforcement and strengthening of pre-treatment control programs, and reduction or elimination of chlorination especially in fresh or brackish water fish spawning and nursery areas and shellfish spawning areas. Recommendations for controlling nonpoint source toxicant loadings

include upgrading permit conditions for dredge-and-fill (404 permits), use of integrated pest management (IPM) and soil conservation practices to control runoff of pesticides and herbicides, improvement/implementation of urban runoff controls, and improving knowledge of the levels and effects of other toxicant sources such as atmospheric deposition, contaminated groundwater, hazardous waste disposal and storage sites, accidental spills, and anti-fouling paints.

In light of the CBP findings and recommendations, the installation assessment methodology has been designed to quantify, where possible, point and non-point source loadings of conventional and toxic pollutants, and to determine, where possible, the effects of these pollutant loadings on the local receiving water, sediment quality, and biological resources. The methodology consists of five major steps as shown in Figure 3.1. The steps are summarized below.

STEP 1. <u>**Calculate Installation Pollutant Loadings**</u>. Quantify, where possible, point and nonpoint source loadings of conventional (BOD, nutrients, coliforms, suspended solids) and toxic pollutants from the installation.

STEP 2. <u>**Calculate Relative Pollutant Loadings**</u>. Quantify, where possible, point and nonpoint source loadings of conventional and toxic pollutants in the installation's surrounding region of influence for the purpose of comparison.

STEP 3. <u>**Evaluate Theoretical Effects of Installation Pollutants**</u>. Quantify, where possible, theoretical effects of installation pollutant loadings on local water and sediment quality and biological resources, using established water quality criteria and bioassay acute and chronic toxicity levels (on a constituent specific and whole effluent basis).

STEP 4. <u>**Perform Vicinity Verification of Theoretical Effects**</u>. Verify, where possible, theoretical effects using historical data and studies on local water/sediment quality, benthic and water column biota, and habitat trends in the vicinity of the installation.

STEP 5. <u>**Summarize Installation Assessment**</u>. Summarize the findings of Steps 1-4. Also, summarize known beneficial effects of installation activities and other potential environmental impacts (i.e., poorly defined or nonquantifiable) and summarize recommended actions. Update the installation screening evaluation of Phase I.

As indicated in Figure 3.1, each step of the process generates interim products/results that are of use in the ongoing environmental planning process. Also, in the event that a lack of data prevents completion of one or more of the steps, the interim result allows the process to be more readily completed or updated later as appropriate data become available to address any incomplete steps. Examples of interim products include: for Step 1 - list of constituents, effluent characteristics, pollutant loadings from point and nonpoint sources on the installation; for Step 2 - same as

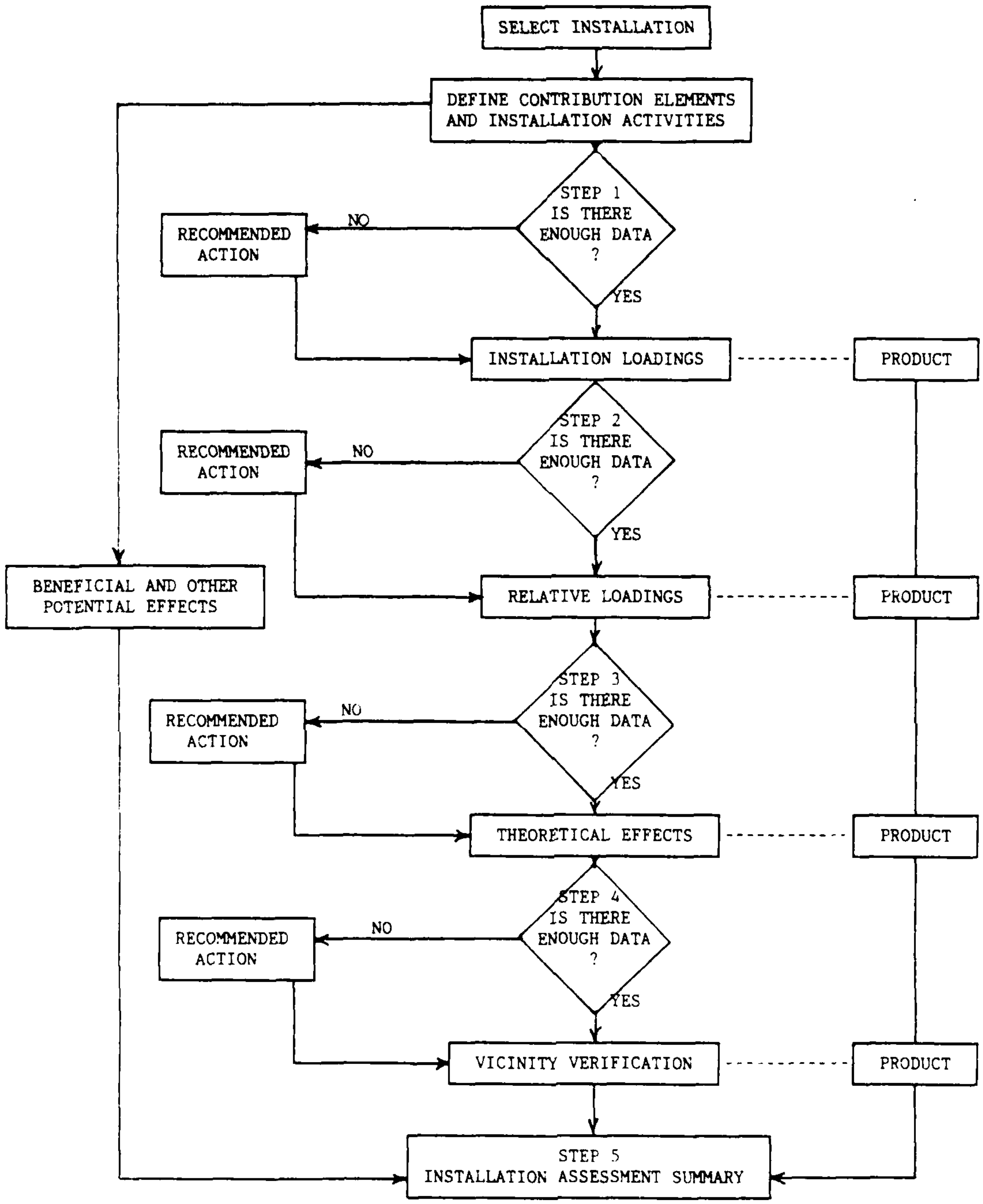

Figure 3.1 Phase II Assessment Methodology

Step 1 but for regional pollutant sources; for Step 3 - summary of theoretical effects of installation pollutant loadings; for Step 4 - summary of vicinity data verification of theoretical effects; etc. Recommended actions generally include the description of a field program or study to generate data or information critical to the completion of the assessment process.

Emphasis in Phases II and III of the study was placed on studies and data collection performed by non-DoD agencies. Treatment plant effluent data archived in the EPA Permit Compliance System (PCS) and from installation Discharge Monitoring Reports (DMR's) were used to estimate point source loadings. Nonpoint source loadings were estimated on an annual basis using methodologies described in the EPA Screening Manual "Water Quality Assessment, A Screening Procedure for Toxic and Conventional Pollutants" (Mills, et al, 1985). Local receiving water and sediment quality concentrations resulting from the installation pollutant loadings were estimated where possible using simple dilution calculations.

The theoretical effects of the estimated water quality/sediment concentrations were evaluated, where appropriate, using state and EPA water quality criteria and EPA's AQUIRE data base on bioassays for specific pollutants. Complex pollutants in point source effluents were also evaluated, where possible, using whole effluent bioassay toxicity results available in the EPA CETIS data base. Finally, theoretical effects were verified, where possible, using available historical vicinity data. Sources of data included several major data bases (e.g., STORET, WASHCOG, USGS, CBP, etc.) as well as site-specific studies performed by Federal, state, and local agencies and universities. Chapter 2.0 of this report presents a description of the data and information sources.

The remaining sections of Chapter 2 present detailed discussions of the technical approaches used in each step of the assessment methodology.

3.2 INSTALLATION ASSESSMENT PROCEDURE

This section describes the technical procedures and analyses which make up the Phase II assessment methodology. A flow chart of the overall methodology is presented in Figure 3.1. The five major steps of the methodology, with expanded flow charts for each of the steps, are presented in the next five sections.

3.2.1 Installation Pollutant Loadings (Step 1)

Figure 3.2 presents a detailed flow chart of Step 1 - Calculate Installation Pollutant Loadings. The purpose of Step 1 is to quantify, where possible, point and nonpoint source loadings of conventional (BOD, nutrients, coliforms, suspended solids) and toxic pollutants from each drainage element on the installation. To facilitate the analysis, the installation is divided into distinct contribution "elements" based on sub-drainage areas. The use of sub-drainage elements allows an estimation of point and nonpoint source pollutant loadings for each stream passing through the installation. Total pollutant loadings can be determined by combining all of the

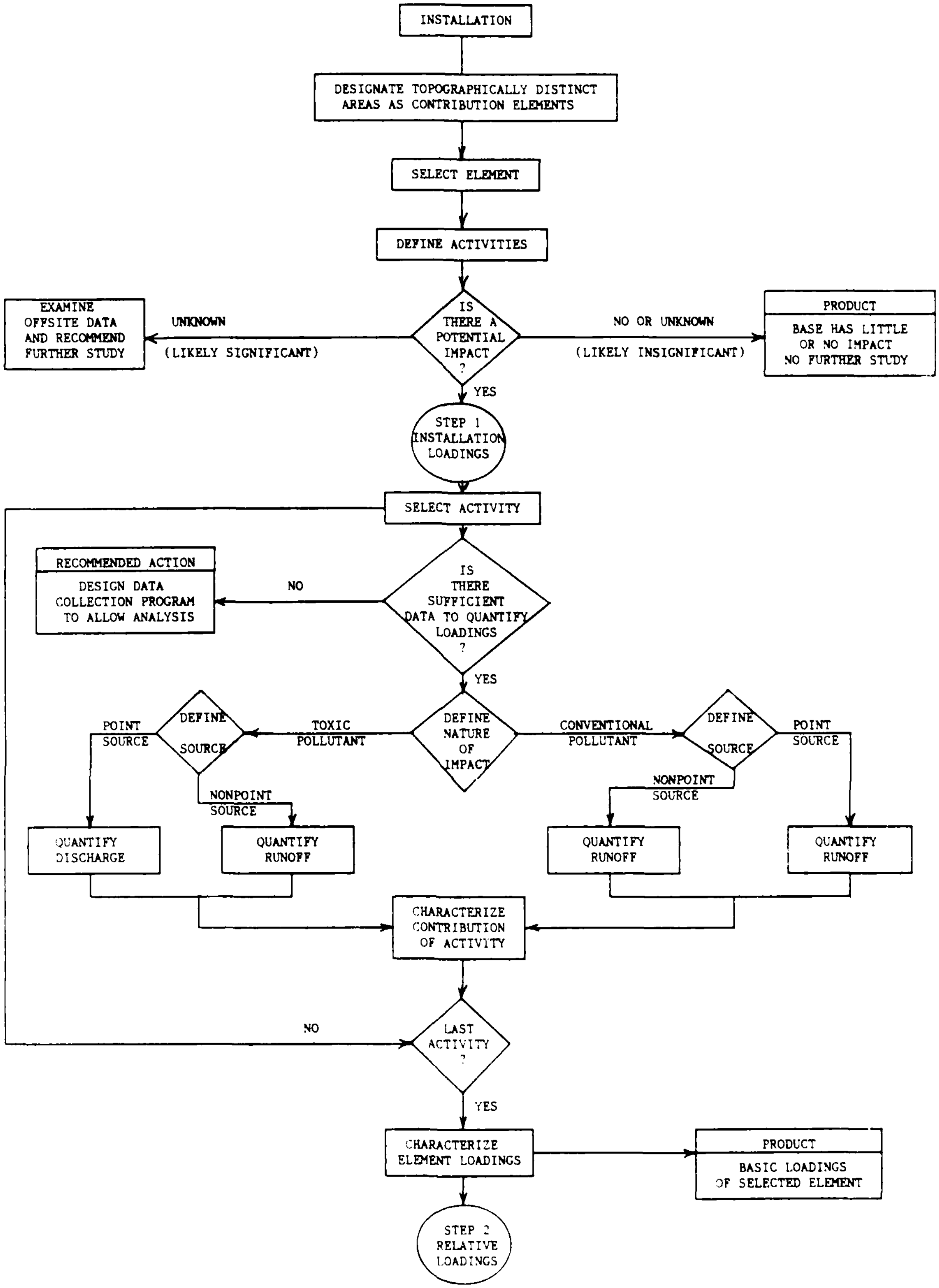

Figure 3.2 Step 1: Calculate Installation Pollutant Loadings

sub-drainage elements for the installation. The use of sub-drainage elements also helps in identifying activities on the installation which are contributing the majority of the pollutants and should be the focus of possible recommendations and/or implementation of controls. For each drainage element, installation activities (e.g., waste treatment, land use, agricultural outleases, fuel spills, etc.) are examined to determine the potential impact on local receiving waters. It should be noted that this function has already been completed as part of the Phase I preliminary screening, which identified 29 of the 66 initial installations as having little or no environmental impact. These installations will receive no further detailed analysis in Phases II and III of the study. The remaining 37 installations, however, will receive detailed analysis.

Many of the activities which generate pollutants cannot be readily quantified. A primary example is an abandoned or active landfill which is suspected of leaching pollutants into the local groundwater system. In most cases, little or no data exist to characterize the pollutant transport rate and extent of migration of the plume from the source. In such cases, all available information and studies are examined to determine the level of significance of potential impacts, and recommendations for further study, if necessary, are noted. These recommendations are summarized under Step 5 - Installation Assessment Summary.

3.2.1.1 Installation Point Sources

In order to assess the impact of an installation's wastewater treatment and disposal practices on the local aquatic environment, it is necessary to document the pollutant characteristics (constituent types/ concentrations, flow rates) of each effluent discharge. Two primary sources of point source effluent data are available. The first source includes state/federal NPDES discharge permits, which stipulate maximum allowable limits for the discharge. These limits can be considered as "worst case" in estimating the waste loading rate for point source discharges. The second source includes effluent sample collection results reported in the installation's Discharge Monitoring Reports (DMR) and performed on a monthly basis. The above information is also available through the EPA Permit Compliance System (PCS) computer data base.

In most cases, the current NPDES permits do not require monitoring of priority pollutants (i.e., toxicants) in the treated effluent. Exceptions include testing for metals or organics in certain industrial waste treatment effluents. Some installations, however, have performed special studies of their treatment system to determine the need for pretreatment or to verify the suspected presence of toxicants. These data, when available, have been included in the characterization of point source loadings.

For each wastewater discharge, a table is prepared listing all known/measured pollutants on the installation. The table includes information on the mean, minimum, maximum, standard deviation, and the mean daily mass loading for each constituent concentration.

3.2.1.2 Installation Nonpoint Sources

Nonpoint sources of pollution are associated with land drainage and enter a receiving water through complex and diverse pathways. Figure 3.3 illustrates some of the pathways which water may take as it flows from precipitation to the receiving waters. The loading functions presented in this section are used to approximate the magnitudes of nonpoint source pollutant loads to the receiving water. The resultant water quality in the receiving water is a function of 1) background loadings which represent the chemical and biological composition of surface waters and result from natural causes and factors and 2) loadings which are a result of human activity. Background loadings represent a baseline or minimum level of water pollution which cannot be eliminated by local or area-wide water quality management. Loadings related to human activity can be reduced or eliminated by effective management programs.

DoD's nonpoint source contributions to the Chesapeake Bay are difficult to address in a quantitative manner. The nature of nonpoint source pollution is such that precise measurements are difficult to obtain, and because it has only recently been acknowledged as a major contributor to water quality, the studies have not been done which would allow application to all situations. Most nonpoint source studies are confined to general agricultural and urban land uses. Areas used for military training and the storage of hazardous wastes as well as intensive industrial areas are examples of land uses for which there is little, if any, information. This lack of information about specific runoff characteristics, coupled with the empirical nature of the analytical calculations of loadings, makes the estimates of loadings presented in this methodology subject to question. They should be used only as "order of magnitude" indicators of problem areas pointing to the need for further study.

The methodology used in this study to determine nonpoint source loadings at an installation is taken from Mills, et al. (1985). The methodology addresses the following functions of water and sediment movement and associated pollutant transport, since pollutants are either dissolved in a water flux or attached to sediment:

Surface water runoff	Streamflow
Solid phase chemical loadings	Dissolved phase chemical loadings
Urban loadings	Sediment yields

The first step in the nonpoint source loadings methodology requires the calculation of surface water runoff, which is based on characteristics at a specific geographic location. Surface runoff is defined as the amount of water (cm/yr) resulting from the average annual precipitation (cm/yr) that remains after loss to groundwater and evapotranspiration. The value for surface water runoff is used in all subsequent calculations to estimate sediment yields, solid and dissolved phase chemical loadings, urban loadings, and receiving water concentrations. In a given drainage basin, the surface water runoff (cm/yr) multiplied by the drainage basin area (m^2)

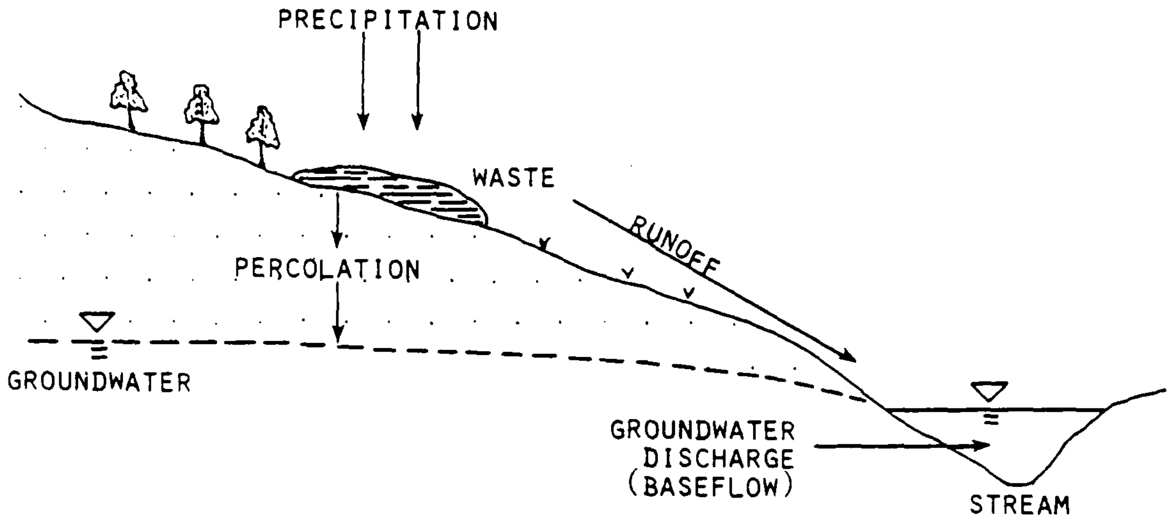

Figure 3.3 The Nonpoint Source Loading Process (Mills, et al., 1985)

gives the annual streamflow or discharge (m^3/yr) of the receiving water. In some areas, surface water runoff has been calculated and is available. If estimates of surface water runoff for a specific geographic location are not available, estimates can be made from available information on a stream draining the area where the surface water runoff value is needed. The value is calculated by dividing the long term average flow (from gaging station measurements) in the stream by the size of the stream's drainage basin and converting that to an annual measurement of surface water runoff. For example, if a stream whose long term average discharge is 1.33 cubic meters per second drains an area of 60 square kilometers the annual surface water runoff is found as follows:

$$\frac{1.33\ m^3/s \times (3600 \times 24 \times 365) s/yr}{60\ km^2 \times 1{,}000{,}000\ m^2/km^2} = .699\ m/yr \qquad (3\text{-}1)$$

The estimated surface water runoff value can then be used for estimating sediment yields and pollutant loadings for the area of the stream's drainage basin that is on the installation.

The above procedure should be used if the streamflow information is available for the installation. Streamflows have been calculated for the entire contiguous United States and are given in McElroy (1947) and are also shown in Mills, et al. (1985). If the information needed to make the above calculations is not available the streamflow can be estimated from one of these references.

Once surface water runoff values have been determined, sediment yields and pollutant loadings are calculated for each of the sub-drainage basins within the installation border.

Before annual sediment yields can be estimated, the Universal Soil Loss Equation (USLE) (Wischmeier and Smith, 1978) is used to predict soil loss from each sub-basin:

$$X = 1.29\ E\ (k)\ (ls)\ C\ (P) \qquad (3\text{-}2)$$

where:

- X = soil loss (tonnes/ha)
- E = rainfall/runoff erosivity index (10^2m-tonne-cm/ha-hr)
- K = soil erodibility (t/ha per unit E)
- ls = topographic factor (linked to land slope)
- C = cover/management factor
- P = supporting practice factor.

These factors have been estimated for each installation based on information presented in Mills, et al. (1985). The USLE allows the estimation of soil loss and thus of pollutant loadings for each drainage basin based on the assumption that nonpoint source loadings are a direct result of and hence proportional to soil loss, and that soil loss is a function of land use.

The land use categories are divided into forest, open, agricultural, urban, and disturbed. The land use categories are based on available information

on specific land uses as defined in the literature and are thus limited to predefined categories. Areas unique to a military installation (e.g., ordnance demolition) as well as areas of terrestrial-aquatic transition (e.g., wetlands and marshes) have not been adequately studied to be incorporated into the methodology. Land use categories are therefore generic in coverage and placement of a specific land use into a category is subject to available information. This is especially true in regards to disturbed areas. The disturbed areas are generally defined as those areas lacking ground cover and subject to high erosion rates or extensively contaminated with pollutants. An area highly contaminated with ordnance or other chemical products but having ground cover cannot be described as disturbed unless extensive soil samples have been taken to quantify the contaminant concentrations and values can then be entered into the calculations of the methodology.

Sediment yields from each basin are calculated based on a summation of the soil loss estimates for each land use.

$$Y = S_d \sum_k X_k A_k \tag{3-3}$$

where:

- Y = annual sediment yield (tonnes/yr)
- X_k = erosion from source k from the USLE (t/ha)
- A_k = area of source area k (ha)
- S_d = watershed sediment delivery ratio

The sediment delivery ratio (S_d) is an attenuation factor for the source area and is given as a fractional number which ranges from 0.1 to 0.4 and is an inverse function of the source area size. Figure 3.4 is a graph of the function from which S_d can be obtained. Most of the sub-basins dealt with in this methodology are relatively small and values are in the 0.3 - 0.4 range for S_d.

The remainder of this section discusses the methodology used to determine nonpoint source pollutant loadings estimates. Solid phase chemical loadings from a non-developed source area are dependent on the mass flux of sediment from the area. The sediment has an in situ concentration of chemicals which are entrained with the soil being transported from a source area. A relationship can be established which describes how this contributes to the overall loadings for each chemical. As with the soil loss equation, there is no substitute for field measurements, but literature on past field studies can provide the basis for a "best guess" estimate of source in-situ chemical concentrations. These concentrations can then be linked to soil loss to provide estimates of loadings. For this study some standard chemicals were used as an initial attempt to obtain loadings. It must be reemphasized that the loadings obtained from this methodology are only crude estimates. Specific field studies would be required to increase the confidence placed in the values obtained. Cadmium, chromium, copper, iron, lead, manganese, nitrogen, and phosphorus were used because of the ready availability of their in-situ concentration estimates available in the

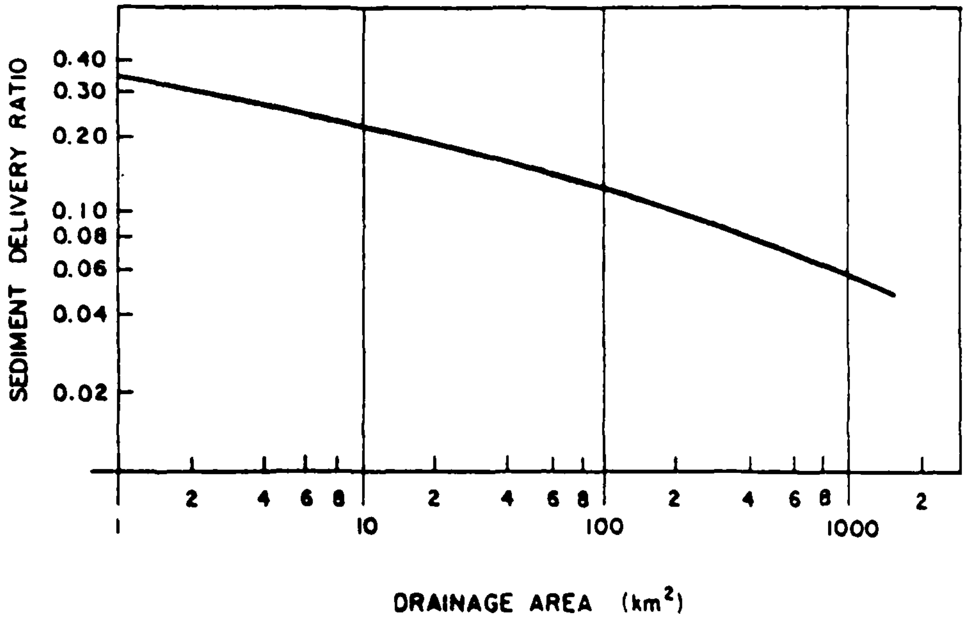

Figure 3.4 Sediment Delivery Ratio as a Function of Watershed Drainage Area (Vanoni, 1975)

general literature. When available, actual site-specific chemicals and their concentrations should be used rather than the estimates. To obtain the loadings the following relationship is used:

$$LS = 0.001 \; Cs \; Y \qquad (3\text{-}4)$$

where:

LS = the solid phase chemical load (kg/ha)
0.001 = a dimensional conversion constant
Cs = concentration of chemical in eroded soil (mg/kg)
Y = sediment yield of the source area (t)

The variable Y comes from the sediment yield of equation 3-3 above. The factor Cs should be obtained by direct measurement, but estimates of concentrations for various locations by land use are summarized in McElroy, et al. (1976) for heavy metals and in Parker, et al. (1946) for nitrogen and phosphorus.

For heavy metals Cs may be used as reported. The preponderance of a metal will be manifested as solid load because of the high tendency of metals to absorb to sediment. Nitrogen and phosphorus, however, must be treated somewhat differently. Since nitrogen and phosphorus tend to be associated with the organic and clay fractions in the in-situ soil they tend to be eroded selectively from the nondeveloped source area. Therefore, Cs is generally larger than Ci (the in-situ concentration) and must be calculated based on an enrichment factor (en):

$$Cs = en \; Ci. \qquad (3\text{-}5)$$

For annual load estimates Mills, et al. (1985) suggests that a mid-range value of en = 2.0 is appropriate.

Dissolved chemical loadings are based primarily on the discharge from a nondeveloped source area. The runoff concentrations should be measured, however, some estimated values for N and P are given in Mills, et al. (1985). The relationship for dissolved chemical loads is given by:

$$LD = 0.1 \sum_k Cd_k \; Q_k \; A_k \qquad (3\text{-}6)$$

or

$$LD = 0.1 \; CdQA \text{ for each source area} \qquad (3\text{-}7)$$

where:

LD = dissolved load (kg)
Cd = concentration of chemical in runoff (mg/l)
Q = discharge (cm)
A = area of source area (ha)

In this study dissolved chemical loadings were calculated only for nitrogen and phosphorus to represent inorganic N (NO_3, NO_2) and orthophosphorus. The values of Cd may vary greatly especially on agricultural lands where fertilizer is used.

Distributed phase chemicals, i.e., those for which partitioning is especially significant, require greater detail of effort and could not be addressed within the scope of this study. These chemicals include the volatile organics, pesticides, and other, more complex, chemicals used in farming, pest control and industrial processes.

Urban loadings from an installation are interpreted to represent the nonpoint source loadings derived from the developed portions of the installation. The chemicals in runoff may include a wide variety of distributed phase chemicals. The loadings calculated for this study, however, include only BOD_5, PO_4, N, suspended solids, and volatile solids. Loadings are obtained using the same logic as rural loads with slight variations. The relationship used for urban loadings is:

$$L_k = \alpha_k F_k \varphi_k P \tag{3-8}$$

where:

L_k = annual pollutant loading from landuse k(kg/ha)
α_k = pollutant concentration factor (kg/ha-cm)
F_k = population density function
φ_k = street cleaning factor
P = annual precipitation

As with the other equations, estimates of these factors are available in Mills, et al. (1985) for various land uses including; residential, commercial, industrial and other land uses.

3.2.2 Relative Pollutant Loadings (Step 2)

Figure 3.5 presents a detailed flow chart of Step 2 - Calculate Relative Pollutant Loadings. The purpose of Step 2 is to quantify, where possible, point and nonpoint source loadings of conventional and toxic pollutants entering surface water in the vicinity of the installation. The ultimate goal of step 2 is to determine the relative contribution of the installation in relation to those in the surrounding region or tributary. Because of the difficulty in estimating regional pollutant loadings, much of this information has been pulled from previous estimates, for example, in the EPA Chesapeake Bay Program reports.

3.2.2.1 Vicinity Point Sources

The primary source of information for estimating vicinity point source loadings is a recently compiled EPA computer data base on major NPDES permitted point sources (flow > 0.1MGD) located below the Fall Line. This data base was produced by the EPA Chesapeake Bay Program office (Macknis, personal communication), and includes effluent characteristics on conventional constituents and, where permits specify, on metals and certain toxics. Effluent data are limited to summer conditions (May - September) and cover 1984-1985. Additional estimates of loadings of conventional

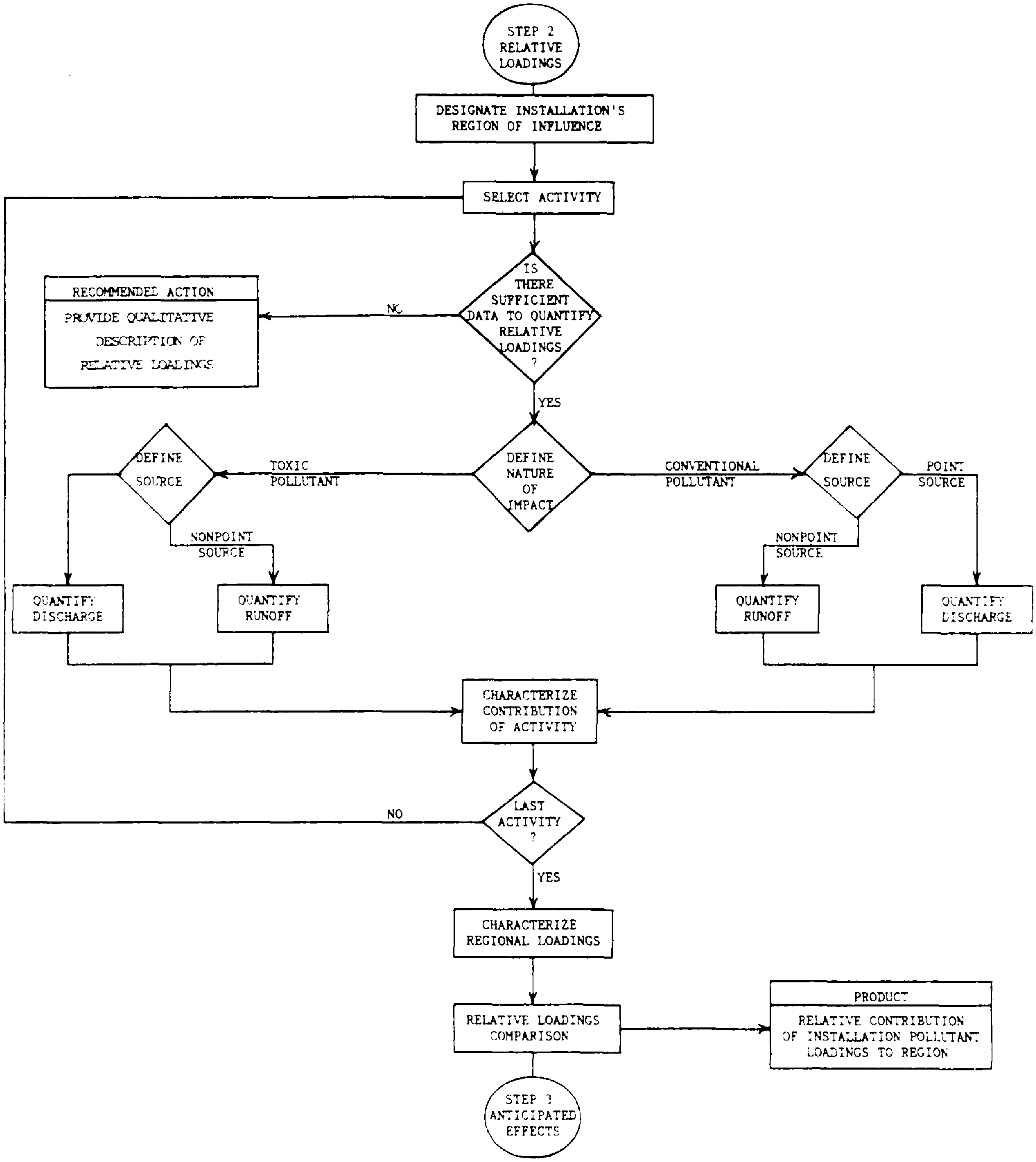

Figure 3.5 Step 2: Calculate Relative Pollutant Loadings

pollutants (BOD, nutrients) and metals in each major tributary to the Chesapeake were presented in the Chesapeake Bay Program reports.

Loadings estimates for point sources above the Fall Line and in the vicinity of a DoD installation can be obtained from EPA's Permit Compliance System (PCS) data base or the IFD file which gives treatment level, flow rate (maximum permitted), and location for all NPDES discharges.

3.2.2.2 Vicinity Nonpoint Sources

As discussed previously, accurate quantification of nonpoint source loadings, even for relatively small and well defined areas, is difficult. No attempt is made in this study to directly calculate the vicinity nonpoint source loadings entering a tributary or embayment. Such calculations have generally been made as part of the watershed runoff model developed during the Chesapeake Bay Program studies (NVPDC, 1984). This study produced estimates of BOD, sediments, nutrients and metals entering the major Chesapeake Bay tributaries at the Fall Line. Additional, more recent research on nonpoint source loadings entering the Bay below the Fall Line has been performed in several, small watersheds.

For small tributaries where published nonpoint source loading estimates may not be available, loading estimates can be made using historical water quality and flow data averaged over the period of interest (normally summer conditions). Water quality and flow data are available in the EPA STORET data base as well as USGS water year data reports for each state.

3.2.2.3 Relative Pollutant Loadings Comparison

The estimates and calculations for point and nonpoint source pollutant loadings can be used to present a comparison, in tabular form, of the DoD installation contributions relative to the total contributions in the installation's immediate vicinity and/or tributary to the Bay. This is a useful exercise to place an installation's activities in proper perspective and also allows convenient grouping of DoD installations on a single tributary and/or Bay-wide for obtaining a regional perspective of DoD contributions. Due to the limited knowledge on point and nonpoint source contributions of toxics, however, the relative loadings comparison necessarily focuses on conventional pollutants, i.e., BOD, sediments, nutrients, coliforms and in some cases, metals.

Because of the difficulty in quantifying loading rates of toxic pollutants, the potential or theoretical impacts of such activities are examined on a more site-specific basis utilizing vicinity data, wherever possible, to develop a correlation between observed water quality/habitat trends and known or suspected toxicant releases. Steps 3 and 4 of the methodology describe this approach, as follows.

3.2.3 Theoretical Effects (Step 3)

3.2.3.1 Introduction

Figure 3.6 presents a detailed flow chart of Step 3 - Evaluate and Define Theoretical Effects. The purpose of Step 3 is to define the theoretical effects of the predicted vicinity water quality conditions by evaluation of available data using laboratory and field generated observations and standards. A general definition of a pollutant for the development of the theoretical effects methodology will be any factor causing a stress or stimulation of an ecosystem beyond the normal or ambient condition. APPENDIX C presents a discussion of the theoretical effects of specific pollutants of interest on the aquatic ecosystem. A simple dilution calculation is made to estimate the vicinity pollutant concentrations for the various constituents in the installation pollutant loadings. A multi-level approach is then used to evaluate the pollutant concentrations using: 1) State water quality standards, 2) EPA water quality criteria, 3) data from the AQUIRE data base, and 4) data from the scientific literature. The evaluation methodology must be general enough to cover all possible classes and types as well as combinations of pollutants. The various pollutants can be divided into three classes based on the nature of the pollutant source: 1) physical (turbidity, heat, pressure); 2) chemical (nutrient, toxicant, mutagen); and 3) biological (pathogen). The pollutant types include conventional and toxicological and may exhibit synergistic and antagonistic properties. Also, the evaluation methodology must be specific enough to evaluate the unique ecological resources within the many hydrogeographical areas in the Bay. Finally, a summary matrix is used to present the pollutant concentrations of concern and the associated theoretical effects of the pollutant on the ecosystem in the receiving water.

3.2.3.2 Evaluate Pollutant Concentration/Define Theoretical Effects

A simple dilution calculation is performed to generate the predicted vicinity water quality condition resulting from point and nonpoint sources on the installation. Ideally, the calculation would include, for each of the constituents, a pollutant concentration in the receiving water, a duration of exposure in the receiving waters, and a frequency of exposure in the receiving waters. Duration of exposure refers to the time of exposure of the receiving water to a concentration and is given as a series of concentration gradients. The frequency of exposure is the time series in which an expected concentration will be exceeded. This level of detail is beyond the scope of the present study. Instead, a simple straight dilution calculation is made which assumes average flow conditions.

The evaluation of the pollutant consists of a multi-level approach to determine if a pollutant concentration is in excess of a set limit or a stressful or stimulatory endpoint. The first level uses information specific for the receiving water of the installation. The next two levels

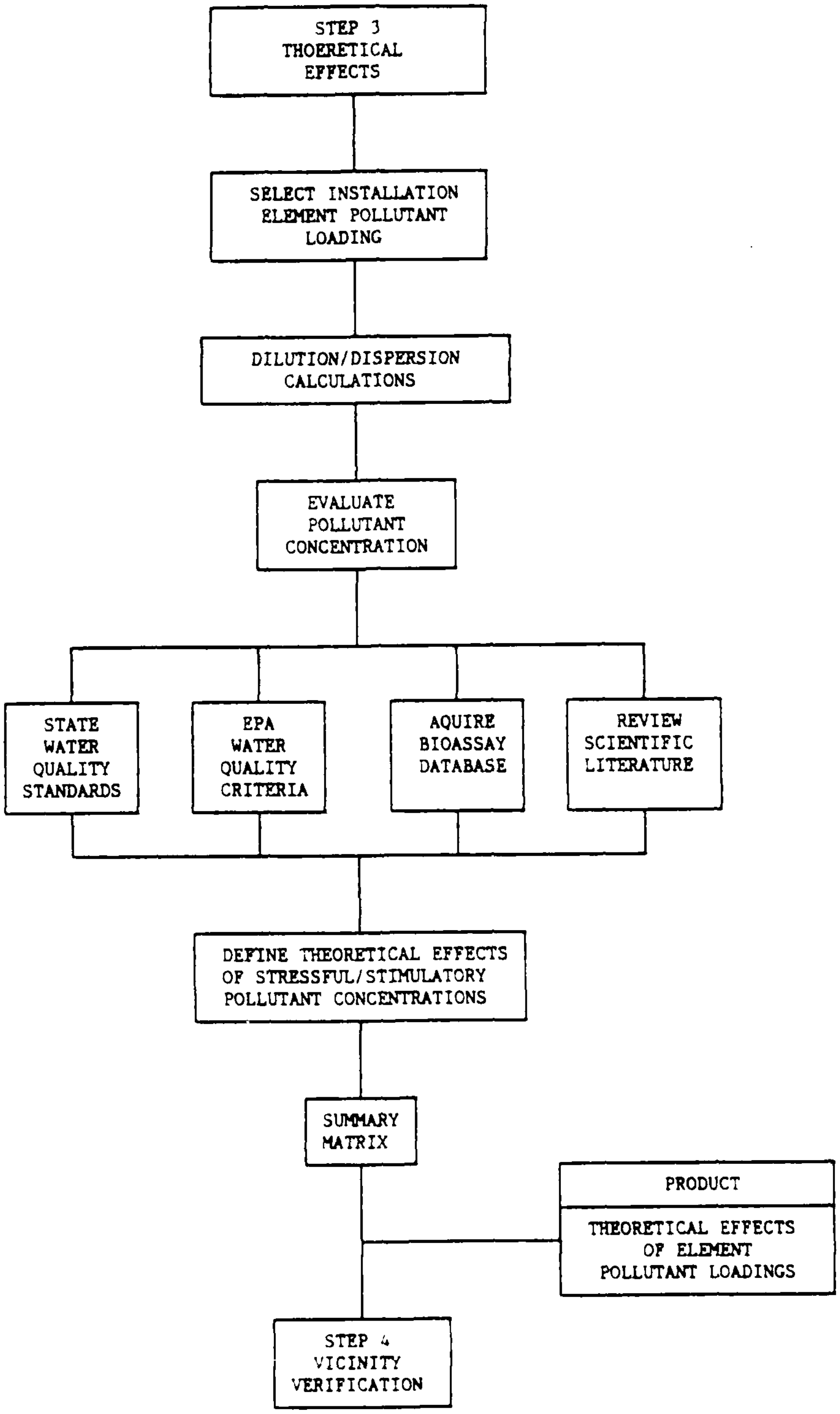

Figure 3.6 Step 3: Evaluate and Define Theoretical Effects

use information for receiving waters in general. The final level uses information in the scientific literature.

In the first level of evaluation, the pollutant concentrations are compared to state standards for the designated use of the receiving water. The state water quality standards for each state are listed in the following references: Code of Maryland Regulations (Maryland, 1985), Water Quality Standards of Virginia (Commonwealth of Virginia, 1986), and Water Quality Standards of Pennsylvania (Commonwealth of Pennsylvania, 1985). The state standards can be general for all waters in a state or they can be specific for each use designation or particular section of water in the state. For example, the state of Virginia has the following standards: the chronic criteria for DDT is 0.001 ug/l in all waters of the state; the chronic criteria for aldrin is 0.03 ug/l and 0.003 ug/l in freshwater and saltwater, respectively, in all waters in the state; and the daily average dissolved oxygen concentration is 5.0 mg/l in Class II-IV waters, 6.0 mg/l in Class V waters, and 7.0 mg/l in Class VI waters of the state. Commonly, the standard will be in numerical form such as "the average daily concentration of total residual chlorine (TRC) in freshwater shall not exceed 11 parts per billion (ug/l)" (Commonwealth of Virginia, 1986). Each state has general guidelines for reporting the standards in terms of average concentration, duration, and frequency. The other forms of the standard can be narrative, i.e., "pollutants must not be present in harmful concentrations" or operational, i.e. "concentrations of pollutants must not exceed one-tenth of the 96-hr LC50" and can be used if numerical standards are not possible or desirable.

The second level of evaluation, after the use of state water quality standards, is the use of EPA established water quality criteria (EPA, 1986). The EPA water quality criteria require that a specific concentration will be exceeded no more than once in three years on average. The above frequency stipulation is based on the recovery of an impacted ecosystem. The typical recovery period for an ecosystem stressed by the exceedence of a water quality criterion is given as three years in the Guidelines for Deriving Numerical Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses (Stephan et al., 1985). This document further states that the recovery of an ecosystem is linked to its resilience and stability as well as its current condition from pollutant and natural stress. A particular receiving body of water may have a different recovery period based on local environmental conditions and biota. EPA water quality criteria, established for over 135 pollutants, are given as criterion maximum concentration (CMC) and criterion continuous concentration (CCC). The CMC is that concentration not to be exceeded in one day in three years and the CCC is that concentration not to be exceeded in four consecutive days every three years. Because the EPA water quality criteria are general guidelines for use nationally, the criteria are divided for application into two types of receiving water, either saltwater or freshwater. The criteria produced by the guidelines of Stephan et al. (1985) are intended to be useful in the development of water quality standards, mixing zone standards, effluent limitations, etc. The application of these guidelines in a regulatory environment by the states may require the addition of social, legal, economic, hydrological,

biological, chemical, and physical factors to relate these to local conditions. Therefore, in using EPA water quality criteria for evaluating the predicted water quality conditions around a given DoD installation, it must be realized that the criteria were developed to protect all or almost all bodies of water and were calculated to protect 95% of the species in the receiving waters of the United States. The characteristics of the receiving water and the species exposed to the pollutant concentrations may result in a national criterion being either overprotective or underprotective.

The concentrations, durations, and frequencies specified in the state standards and EPA criteria are based on biological, ecological, and toxicological effects data and are designed to protect aquatic organisms and their use from unacceptable effects. A comprehensive testing program in the laboratory is used to generate effects data from bioassays performed throughout the country. The results of the bioassay tests give information on the lethal and sub-lethal effects of the pollutant to aquatic species. These effects include death, bioaccumulation of pollutant, and physiological responses such as decreased growth and juvenile survival. The data base used for water quality guideline development is put together by EPA and is called the Aquatic Information Retrieval Toxicity Data Base (AQUIRE). AQUIRE provides a comprehensive, systematic, and computerized compilation of aquatic toxicity data (Russo and Pilli, 1984). AQUIRE is maintained and updated by the U.S. Environmental Protection Agency, Environmental Research Laboratory, Duluth, Minnesota. The data base contains acute, sublethal, and bioaccumulation effects on freshwater and saltwater plants and animals except bacteria, birds, adult amphibians, and mammals. A unique characteristic of AQUIRE is the incorporation of a data quality review code. Depending on the methodology, documentation, and caliber of test methods, encoded data from tests are assigned a quality rating for reliability of results.

The states develop their own water quality standards with review by EPA. They either adopt the EPA water quality criteria as their standards or develop their own water quality standards. The information for the development of national, state, and site-specific water quality guidelines has been prepared in the Water Quality Standards Handbook (EPA, 1983) and the Guidelines for Deriving Numerical Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses (Stephan et al., 1985).

The AQUIRE data base also is used in the third level of evaluation to develop comparisons of specific species in the receiving water segment with the predicted pollutant concentration, especially if there are no state or EPA water quality guidelines. Species used in these comparisons include resident species, migrating species passing through the receiving waters, and intermittent species having seasonal or occasional occurrences. The data base can be used to establish if any stressful or stimulatory effects on a particular species from the predicted pollutant concentration exist, even though there has not been enough testing to develop a national or state water quality guideline for that pollutant.

The final level of evaluation of the predicted vicinity pollutant concentrations includes a review of the literature for specific laboratory

and field data and case studies. For example, the conventional pollutants have not been assayed as much as the toxicants and mutagens. But, information is available on the effects of BOD (low dissolved oxygen) and turbidity (light attentuation) as well as information on exotic pollutants such as pressure waves from underwater explosives and electromagnetic waves. In addition, general observations as well as specific case studies of related pollution monitoring studies are used to supplement the information in the above levels of evaluation. APPENDIX C presents a discussion of the theoretical effects of specific pollutants of interest on the aquatic ecosystem.

3.2.3.3 Summary Matrix.

The above evaluation is presented in a matrix summarizing the pollutants of concern and their potential effects on the receiving water ecosystem. The effects are divided into three types of manifestations in the environment - physical, chemical, and biological. The physical manifestations of the pollutant include visual observations such as fish kills or high turbidity. The chemical manifestations of the pollutant include analytical determination of its characteristics such as low pH or high ammonia concentration. The biological manifestations include the stressful or stimulatory effects on the physiological, community, and habitat components of the ecosystem and would include, for example, histopathologies, low diversity, and sediment deposition. Table 3.1 gives the biological components and lists the characteristics of each that may be affected by stressful or stimulatory pollutant concentrations. Bioassay data would include the AQUIRE data base information for data on specific species response to various pollutant concentrations.

The summary matrix is useful in assessing the pollutant concentrations of concern and the theoretical effects on the ecosystem in the receiving waters. The next step in the overall methodology is the verification of the theoretical effects in the vicinity of the installation.

3.2.4 Vicinity Verification (Step 4)

3.2.4.1 Introduction

Figure 3.7 presents a detailed flow chart of Step 4 - Vicinity Verification of Theoretical Effects. The purpose of Step 4 is to verify the theoretical effects of the predicted vicinity water quality conditions by examining historical vicinity data in the area of the installation. Historical vicinity data sources include several major data bases as well as regional and site specific studies performed by Federal, state, and local governments and by academic institutions. Selected vicinity data may be either biotic or abiotic. Biotic data consist of observed effects on aquatic organisms and habitats. Abiotic data consist of observed effects on sediment or water column parameters. Habitats can be abiotic as well as biotic but will be considered under biotic data because of the relationship by definition to aquatic organisms. The collected vicinity data are summarized to give

Table 3.1 List of the Parameters of Each Variable Used in the Theoretical Effects and Vicinity Verification Procedure

PHYSIOLOGICAL	
histopathology	phenotypic and genotypic variation
fecundity	interactions of stress indicators
growth rate	behavior
disease	
COMMUNITY	
species composition	abundance
density	function
structure	diversity
productivity	biomass
resilience	stability
geographic specificity	population interactions
trophic relationships	life history
HABITAT	
wetlands	oyster shell
sand bar	nursery/nesting areas
submerged aquatic vegetation	
SEDIMENT	
redox depth	texture
pollutant concentrations	particle composition
size	organics
WATER COLUMN	
secchi depth	pH
salinity	turbidity
density	organics
pollutant concentrations	

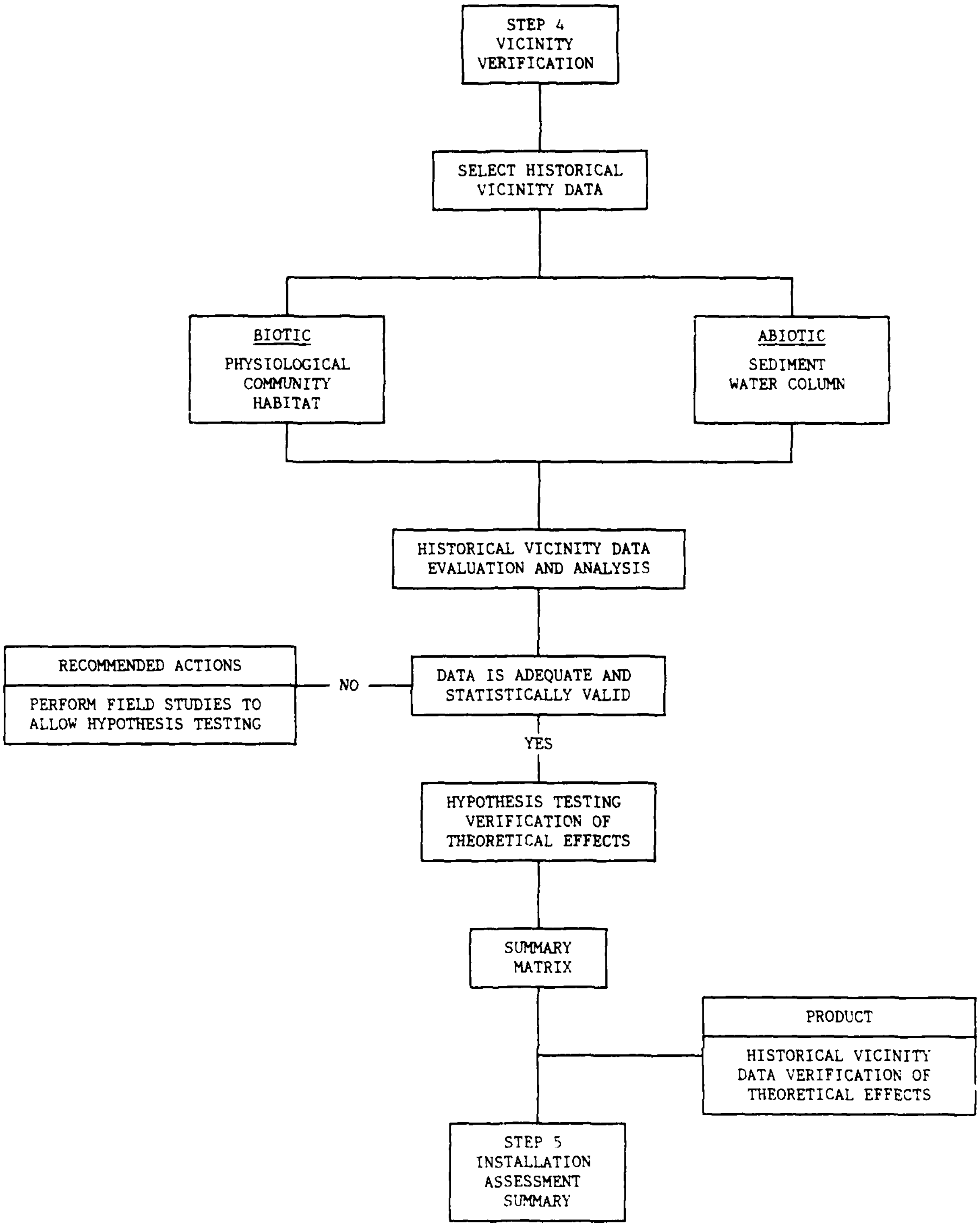

Figure 3.7 Step 4: Vicinity Verification of Theoretical Effects

descriptive statistics, evaluated to determine adequacy of study method, and analyzed to verify the theoretical effects. Finally, a summary matrix is used to present the pollutant concentrations of concern and the historical vicinity data used to verify the theoretical effects. If vicinity data are lacking, incomplete, or inadequate for the verification of the theoretical effects, a field program or study will be recommended to generate data or information to complete step 4 of the methodology.

3.2.4.2 Historical Vicinity Data Selection

Historical vicinity data sources include several major data bases as well as regional and site specific studies performed by Federal, state, and local governments and by academic institutions. The data bases and reports present the combined sampling effort for the Chesapeake Bay and tributary rivers and provide the historical vicinity data for verification of the theoretical effects. These documented and quantified data on the effects of pollutants in the field are considered the most reliable and meaningful measures of pollution. The field study, to be useful in a regulatory or assessment capacity, should accomplish the following objectives: 1) be based on a strong and effective design, 2) relate observations to specific causes, 3) measure the broad importance of an observed modification to an ecosystem component, and 4) allow application of the results to an enforceable pollution reduction program. The reports and data bases are examined for all pertinent historical vicinity data in the temporal and spatial coverage needed to achieve the above objectives.

The vicinity data selected for the verification of the theoretical effects may be either biotic or abiotic. The biotic data can be divided into three categories: physiological, community, and habitat. The abiotic data can be divided into two categories: sediment and water column. Table 3.1 presents the parameters included in each category listed below their respective heading. Habitats can be abiotic as well as biotic but will be considered under biotic data because of the relationship by definition to aquatic organisms.

The whole effluent bioassay is one type of biotic, physiological measure that will be used in future compliance biomonitoring for NPDES discharges. The data base for this information is called the Complex Effluent Toxicity Information System (CETIS). This data base assembles the results of effluent toxicity tests so toxicity characteristics of complex effluents can be determined. To date, the testing has been performed on less than ten of the military bases in the present study.

The whole effluent toxicity approach, as described in the Technical Support Document for Water Quality-based Toxics Control (EPA, 1985) involves the use of certain test species to measure the toxicity of industrial and municipal wastewater discharges. The endpoint can be mortality, lower fecundity, reduced growth, or some other measure of biological stress. The lowest effluent concentration that causes that endpoint is then calculated. The lowest endpoint concentration becomes a quantified measure of the concentration that would cause instream adverse effects if exceeded for a

particular length of time. It is usually stated either as an LC50 (the effluent concentration at which 50% of the test organism are killed) or a No Observed Effect Level or NOEL (the highest effluent concentration at which no unacceptable adverse effect will occur even at continuous exposure). The measurement of whole effluent toxicity can be used to document an undesirable effect caused by the discharge of a complex mixture of waste materials. Validity of effluent testing for predicting biological impact on Five Mile Creek, Alabama is reported by Mount et al. (1985). The "Method for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms" by Peltier and Weber (1985) gives the appropriate procedures and guidelines for performing acute bioassays. "Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms" by Horning and Weber (1985) gives the appropriate procedures and guidelines for performing chronic bioassays.

3.2.4.3 **Historical Vicinity Data Evaluation and Analysis**

The collected historical vicinity data are summarized using descriptive statistics including means, standard deviations, and confidence intervals. The overall sample design used to collect the vicinity data is then evaluated to determine if the design was adequate and statistically valid to address the verification of the theoretical effects. The data are examined for number of replicates, missing data, methodology, temporal and spatial coverage, and quality control and quality assurance practices. If the sample design is determined to be inadequate and/or invalid, then case studies involving similar impacts and effects are examined and documented. If the historical vicinity data are adequate and statistically valid, the vicinity data are analyzed using comparative parametric and non-parametric statistics including ANOVA, classification, ordination, and regression. The hypothesis to be tested is whether the historical vicinity data verifies the presence of the theoretical effects in Step 3 and whether the installation is wholly or partly responsible. Control or reference sites are used when they do not involve comparison between areas under different physical and/or stressed conditions. If studies must be combined to assist in vicinity verification, data are utilized that are comparable in sample methodology.

3.2.4.4 **Summary Matrix**

The above historical vicinity data will be presented in a matrix summarizing the pollutant concentrations of concern and the historical vicinity data used to verify the theoretical effects of the pollutants on the receiving water ecosystem. The verification data are divided into three categories and correspond to the manifestations found in the theoretical effects summary matrix (Step 3). This one-to-one correlation enables a quick comparison of the pollutants of concern, the theoretical effects of these pollutants, and the vicinity verification data for those pollutants. The physical, chemical, and biological verification data serve to corroborate the theoretical effects data and document field studies establishing the observation of the theoretical effect. The documented observations would include data from field studies such as high mercury concentrations in fish tissue or bottom sediments of an embayment. Bioassay data on tested

discharges (which are available for certain installations) are additional biological response verification data and would be included in the CETIS program. The final column lists the recommendations for generating verification data through field studies if vicinity data are lacking, incomplete or inadequate for the verification of the theoretical effects.

The summary matrix is useful in assessing if the theoretical effects defined in Step 3 are documented in the field and, if not documented, what types of vicinity data should be measured to verify the theoretical effects. Step 5 in the assessment methodology provides a characterization of the water quality conditions where the findings of Steps 1-4 are summarized. Also, Step 5 will summarize the known beneficial effects of the installation activities, other potential environmental impacts, and the recommended actions produced in Steps 1-4.

3.2.5 Installation Assessment Summary (Step 5)

The final step of the installation assessment methodology summarizes the major findings of the previous four steps. In addition, this step will summarize known beneficial effects of installation activities, qualitatively describe other potential environmental impacts (i.e., poorly defined or nonquantifiable), and summarize all recommended actions. The installation screening procedure used in Phase I will also be updated with the information analyzed in Phase III to develop the Phase III screening of all installations.

3.2.5.1 Summarize Findings

This section will briefly restate the major findings of the detailed installation assessment performed in the first four steps of the methodology. The purpose of this section is to provide a quick review of the most significant issues concerning actual or potential environmental impacts on surface receiving waters at a given installation.

3.2.5.2 Summarize Beneficial Effects

A separate summary section is provided to briefly describe any installation activities or practices which have resulted in positive environmental effects and/or benefits to the surrounding receiving water resources. Examples of such activities could include: progressive land use management programs which include BMP's for erosion control, stormwater runoff control, etc.; progressive programs for toxics pretreatment and toxics monitoring in waste treatment systems; upgrading of old or inadequate waste treatment systems; ongoing water quality monitoring programs; or natural resources programs which have emphasized conservation and/or reclamation of critical wildlife habitats.

3.2.5.3 Summarize Potential Impacts

The primary focus of the present study is on the surface water resource, which responds primarily to the direct discharge (intentional or accidental) of point and nonpoint source pollutants. There may exist, however, other potential or actual environmental impacts at an installation which, although not directly involving surface waters, are nevertheless of interest. The purpose of this section is to summarize other known installation activities which are either causing significant contamination of groundwater, or have the potential to cause significant ground or surface water contamination. Much of this information will be taken from other studies recently performed at an installation; i.e., NACIP, IRP, self audits and DESR investigations. This information is useful to help DoD identify common problem areas at DoD installations for planning and prioritization of mitigation resources.

3.2.5.4 Summarize Recommended Actions

A key objective of this project is to identify studies, practices or projects that could be implemented at specific locations to restore and protect the living resources of the Bay. In Steps 1 through 4 of the assessment methodology, specific recommendations are made to address areas where DoD actions are having an effect on Bay resources. These recommendations may include, for example, water quality monitoring programs, effluent toxicity testing programs, or the institution or upgrading of natural resources plans. The recommended actions are developed as a result of the theoretical and vicinity verification effects matrices discussed earlier for each installation. These recommended actions are restated in the summary section for added emphasis.

3.2.5.5 Update Installation Screening

A major objective of this study is to provide an overview of all DoD activities in the Chesapeake Bay drainage basin. This overview will allow an understanding of the relative impact of DoD installations on the Bay and its tributaries, as well as provide an identification of problem areas as well as successful programs or practices at DoD installations. Phase I of this study presented a screening methodology which was applied to all 66 installations to develop a preliminary understanding of the relative impacts of DoD activities, and to identify those installations requiring additional analysis. Since the Phase I screening, additional information has been developed, refined and analyzed at those installations, resulting in a more educated assessment of critical problem areas and a set of recommended actions to address these areas. An updated screening of all installations is performed which reflects the findings of the more detailed assessments. The screening process follows the same procedure as for the Phase I screening (see Chapter 3, Tetra Tech, 1986). The major difference is that in Step 2 (Screening Data), the preliminary screening data is replaced by the data and information developed during the Phase II and III assessments. Using this information, and the same Screening Criteria (Tables 3.2 and 3.3)

Table 3.2 **Phase** I On-Site Screening Criteria

Nonpoint Sources	1. Erosion/Siltation 2. Impervious Area Runoff 3. Combined Storm Drains 4. Shoreline Erosion
Point Sources	5. Sewage Treatment 6. Industrial Waste Treatment 7. Intermittent Sewage Treatment
Hazardous/Toxic Materials	8. Refueling Operations 9. Munitions Operations 10. Chemicals Operations 11. Pesticides Use 12. Vehicle Maintenance (vehicle wash racks) 13. Ship Maintenance 14. Solid Waste Disposal 15. Hazardous Waste Handling/Storage 16. Spill Prevention, Countermeasures and Control (SPCC) Plans 17. Abandoned Hazardous Waste Dumpsites 18. Leaking Underground Storage Tanks (LUST)
Environmental Programs	19. Forestry Management Plans 20. Wildlife/Habitat Management Plans 21. Soil Conservation Programs 22. Stormwater Management Plans 23. Wetlands Management Plans (including SAV) 24. Shoreline Erosion Plans

Table 3.3 Phase I Vicinity Screening Criteria

Receiving Water Sensitivity	25. Shellfish Areas 26. Submerged Aquatic Vegetation (SAV) Beds 27. Fish Spawning/Nursery Areas 28. Wetland Areas 29. Waterfowl Nesting/Wintering Areas 30. Endangered Species 31. Relative Impacts on Tributary

and Criteria Guidelines (Table 3.4), the *installations are rescreened and* assigned to one of the following four Study Groups.

Study Group 1	Installation has Significant* Existing or Potential Impacts (Adverse or Beneficial)
Study Group 2	Installation Impact Potential is Poorly Defined but Likely Significant (Adverse or Beneficial)
Study Group 3	Installation Impact Potential is Poorly Defined but Likely Insignificant (Adverse or Beneficial)
Study Group 4	Installation has Insignificant Impact Potential.

3.3 SUMMARY

An assessment methodology has been presented which is used to evaluate the environmental impact potential of the 37 installations which survived the Phase I screening process. The methodology combines both quantitative (where possible) and qualitative analysis procedures to identify the relative significance of a wide variety of contaminant sources on the environmental health of the receiving waters. The assessment methodology is highly dependent on the availability of data on contaminant source characteristics, and receiving water quality conditions in the vicinity of the installation. Where information is lacking, and a potential impact is probable, recommendations are made to fill the information gaps. A qualitative review of other potential impacts that do not necessarily have a direct impact on surface waters is also performed to identify common problem areas on a basin-wide scale. The results of the assessment methodology application will be summarized through an updated screening of all 66 installations, and a listing of recommended actions for ongoing consideration by DoD. The assessment methodology and screening procedure are designed to allow updates on a periodic basis as new information becomes available.

* Note: "Significant", as used in this study, is a relative term used to compare potential impact levels on water quality between the 66 DoD installations in order to identify and prioritize common areas of concern. This term is not necessarily intended to signify presence of a "statistically significant" impact, as data to show this are generally not available.

Table 3.4 SCREENING CRITERIA GUIDELINES FOR INSTALLATION EVALUATION

On-Site Screening Criteria	IMPACT CATEGORY 1 Significant Existing or Potential Impacts		IMPACT CATEGORY 2 Impacts Poorly Defined or Unknown		IMPACT CATEGORY 3 Insignificant Impacts
	θ Significant Impact Potential (Adverse)	● Significant Impact Potential (Beneficial)	- Unknown/Poorly Defined Impacts (Adverse)	+ Unknown/Poorly Defined Impacts (Beneficial)	• Insignificant Impact Potential (adv. or bene.)
A. Non-Point Sources					
1. Erosion/Siltation	Significant erosion observed; or >100 acres Agri. Outlease or Clear Cutting; or >100 acres disturbed soils w/o controls	Effective Soil Conservation Prog; >90% of base undisturbed; or have reclamation programs and routinely use BMP's to control erosion.	Same as "0" but erosion level unknown.	Same as "0" but effectiveness unknown.	No erosion problem or no drainage to surface waters.
2. Impervious Surface Area Runoff	High % impervious area and few or no controls; observed water quality impacts from runoff.	Observed water quality improvements after implementation of runoff controls.	High % impervious area and few or no controls. Impacts, if any, unknown.	Have BMP's (i.e., runoff retention basins, street cleaning, etc.) but impacts unknown.	Low % impervious area and normal use.
3. Status of Combined Storm/Building Drains/boiler blowdown/backwash/wash racks/etc.	Chronic violations of NPDES permit and/or observed water quality problems; or no NPDES permit and required.	Combined drain effluent is treated; have effective Storm Water Mgmt Plan.	Combined drains exist but no NPDES permit and no monitoring data; or no Stormwater Mgmt. Plan exists.	Have Stormwater Mgmt. Plan but effectiveness not known.	No combined storm drains.
4. Shoreline Erosion	Shoreline structures/disturbance has or is causing significant erosion problems.	Previous erosion problems corrected.	Erosion is occurring; cause unknown.	Corrective Action Taken; probable long term effect unknown.	Not Applicable or minor.
B. Point Sources					
5. Location and Type of Sewage Treatment Plant (and Pretreatment, if applicable)	Poor Dilution or discharge to small tributary; >.5MGD and not tertiary; or chronic NPDES violations; or receives industrial waste not pretreated; or observed water quality problems.	Good Dilution or discharge to large tributary; tertiary; has dechlorination; efficient operation; industrial waste; if any, is pretreated; no NPDES violations; good water quality.	Unknown Dilution; <.5MGD but not tertiary; unknown efficiency; water quality impacts unknown.	Unknown Dilution; tertiary; efficiency unknown; water quality improvements unknown.	Sewage treated offbase.

Table 3.4 SCREENING CRITERIA GUIDELINES FOR INSTALLATION EVALUATION

On-Site Screening Criteria (continued)	IMPACT CATEGORY 1 Significant Existing or Potential Impacts		IMPACT CATEGORY 2 Impacts Poorly Defined or Unknown		IMPACT CATEGORY 3 Insignificant Impacts
	θ Significant Impact Potential (Adverse)	● Significant Impact Potential (Beneficial)	- Unknown/Poorly Defined Impacts (Adverse)	+ Unknown/Poorly Defined Impacts (Beneficial)	• Insignificant Impact Potential (adv. or bene.)
6. Location and Type of Major Industrial Waste Treatment Processes and Discharges	Poor Dilution or discharge to small tributary; Chronic NPDES violations or permit not current; or observed water quality problems; or pretreatment needed.	Good Dilution or discharge to large tributary; no NPDES violations and current permit; good water quality; pretreatment performed; recovery processes implemented.	Unknown Dilution; effluent poorly characterized; need for pretreatment unknown; water quality impacts unknown.	Unknown Dilution; effectiveness of pretreatment unknown; water quality impacts unknown.	No Major Industrial waste produced.
7. Treatment of Remote Sanitary Sewage (Not Requiring NPDES permits)	Not treated; or inadequate treatment and observed water quality problems.	Remote sites tied into main treatment system; water quality improvements observed.	Unknown or questionable treatment methods; water quality unknown.	Treatment methods appear effective; water quality unknown.	None or sewage treated off base.
C. Hazardous/Toxic Materials					
8. Refueling Operations	Major Operations and Current/recent spills; or adverse impacts observed.	Past Operations substantially upgraded or decommissioned; no major spills; and water quality improvements observed.	Major Operations; past chronic spill history; unknown effects.	Operations Upgraded or decommissioned; water quality effects unknown.	None or Minor.
9. Munitions Production/ Use/Testing/Storage	Inadequate Waste Treatment (Pink Water) or testing procedures; impacts observed.	Past operations substantially upgraded or decommissioned; water quality improvements observed.	Effects of Munitions Activities unknown.	Special treatment facilities but effects unknown.	None or Minor.
10. Chemicals Production/ Testing/Use/Storage	Major Activities; Inadequate Procedures; observed impacts or recent spills.	Past operations substantially upgraded or decommissioned; water quality improvements observed.	Effects of Activities are unknown; past spill history.	Have special treatment or controls on use but effectiveness unknown.	None or Minor.

Table 3.4 SCREENING CRITERIA GUIDELINES FOR INSTALLATION EVALUATION

On-Site Screening Criteria (continued)	IMPACT CATEGORY 1 Significant Existing or Potential Impacts		IMPACT CATEGORY 2 Impacts Poorly Defined or Unknown		IMPACT CATEGORY 3 Insignificant Impacts
	θ Significant Impact Potential (Adverse)	⊕ Significant Impact Potential (Beneficial)	− Unknown/Poorly Defined Impacts (Adverse)	+ Unknown/Poorly Defined Impacts (Beneficial)	• Insignificant Impact Potential (adv. or bene.)
11. Pesticide Use/ Storage	Major Activities; Inadequate Procedures; observed impacts of recent spills or use; routine use of persistent or highly toxic pesticides; especially direct application to marshes.	Past operations substantially upgraded or decommissioned; water quality improvements observed; started Integrated Pest Mgt. or biological pest controls.	Effects of Activities are unknown; past spills or improper use history; no clean up performed.	Have special controls on use but effectiveness unknown.	None or Minor.
12. Vehicle Maintenance	Major Activities; Inadequate Procedures; observed impacts.	Past operations substantially improved or decommissioned; water quality improvements observed.	Effects of Activities are unknown; procedures are possibly inadequate.	Have special procedures but effectiveness unknown.	None or Minor.
13. Ship Maintenance	Major Activities; Inadequate Procedures; observed impacts.	Past operations substantially improved or decommissioned; water quality improvements observed.	Effects of Activities are unknown; procedures are possibly inadequate.	Have special procedures but effectiveness unknown.	None or minor.
14. Solid Waste Disposal (Current)	Landfill(s) contain toxics; Leachate migration observed; or no permit exists.	Modern Landfill; Leachate control and treatment.	Landfill management questionable; no monitoring program	Modern Landfill; Leachate controls but no treatment or monitoring.	Offsite Disposal.
15. Hazardous Waste Handling/Storage (including tenant activities)	Chronic history of recent spills/accidents; inadequate storage facilities; outside storage; standard handling procedures not followed; RCRA Part B not approved or fully implemented.	Past operations decommissioned; water quality improvements observed; RCRA Part B fully implemented.	Volume generation >100kg/month; Handling/storage procedures questionable; incidental or minor spill history; water quality impacts unknown.	Volume generation >100kg/month; No problems reported; no impacts observed; good handling/ storage records; facilities in compliance.	No generation of hazardous waste. <100kg/month

Table 3.4 SCREENING CRITERIA GUIDELINES FOR INSTALLATION EVALUATION

On-Site Screening Criteria (continued)	IMPACT CATEGORY 1 Significant Existing or Potential Impacts		IMPACT CATEGORY 2 Impacts Poorly Defined or Unknown		IMPACT CATEGORY 3 Insignificant Impacts
	⊖ Significant Impact Potential (Adverse)	⊕ Significant Impact Potential (Beneficial)	- Unknown/Poorly Defined Impacts (Adverse)	+ Unknown/Poorly Defined Impacts (Beneficial)	• Insignificant Impact Potential (adv. or bene.)
16. Onsite Spill Contingency Plans/ Equipment	Have haz. waste generation but no SPCC plan and/or no onsite equipment.	Impementation of SPCC plans has resulted in elimination of spill problems and water quality improvements observed.	Status of SPCC not known or not implemented; Status of equipment not known; chronic spills occurring.	SPCC current and in compliance; have adequate on site equipment and clean-up capability.	No hazardous waste generation and no or minor POL activity.
17. Old/Abandoned Haz. Waste Sites/ (landfills, fire training pits, dump-sites, spill sites, etc.)	Have one or more confirmation sites; and Leachate migrating near and towards surface waters; and/or detected in surface waters.	Site(s) cleaned up; and water quality improvements observed.	Have one or more confirmation sites; Leachate is not moving *towards surface waters* or detected; or other sites exist but de*tection of problems* unknown.	Site(s) cleaned up; effects unknown.	No hazardous waste sites on base.
18. LUST/UST	Have one or more LUST's; leachate migrating near or towards surface waters; and/or detected in surface waters.	LUST sites cleaned up; water quality improvements observed.	UST program not completed; have one or more LUST's but leachate migration not documented.	LUST sites cleaned up; effects unknown.	No LUST sites.
D. Environmental Programs					
19. Forestry Management Plan	Extensive clearcutting; or clearing with inadequate erosion controls; observed significant erosion.	Past clearcutting/clearing practices stopped or under strict controls; erosion problems halted.	Have plan but implementation unknown; possible adverse impacts may outweigh benefits.	Have plan but implementation unknown; possible benefits may outweight adverse impacts.	Not Applicable.
20. Wildlife Management/ Habitat Management Plans	No plan or plan not adequately implemented; habitats significantly altered or destroyed.	Plan promotes protection and enhancement of habitats, effective management of wildlife population.	No plan, or have plan but implementation unknown; possible adverse impacts may outweigh benefits.	Have plan but informations unknown; possible benefits may outweigh adverse impacts.	Not Applicable.

Table 3.4 SCREENING CRITERIA GUIDELINES FOR INSTALLATION EVALUATION

On-Site Screening Criteria (continued)	IMPACT CATEGORY 1 Significant Existing or Potential Impacts		IMPACT CATEGORY 2 Impacts Poorly Defined or Unknown		IMPACT CATEGORY 3 Insignificant Impacts
	θ Significant Impact Potential (Adverse)	● Significant Impact Potential (Beneficial)	− Unknown/Poorly Defined Impacts (Adverse)	+ Unknown/Poorly Defined Impacts (Beneficial)	• Insignificant Impact Potential (adv. or bene.)
21. Soil Conservation Program	No plan or plan not adequately implemented (i.e., no erosion controls, disturbance of steep slopes, etc.); or allow agric. out-leasing; observed significant erosion.	Plans is effectively implemented; erosion controls in place; eroded areas/silted in water-ways rehabilitated; environmental benefits observed.	Have plan but imple-mentation/effectiveness unknown; possible adverse impacts may outweigh benefits.	Have plan but imple-mentation/effectiveness unknown; possible benefits may outweigh adverse impacts.	Not Applicable.
22. Stormwater Management Plan	None, but needed; or exists, but poorly implemented; water quality impacts observed.	Plan is effectively implemented; environmental benefits are observed.	No plan and water quality impacts unknown.	Have plan but effectiveness/imple-mentation unknown.	Not Applicable or minor activity/need.
23. Wetlands Management Plan	None, but needed; or exists, but poorly implemented; wetlands impacts observed.	Plan is effectively implemented; wetlands restored or improved.	No plan and wetland impacts unknown.	Have plan but effectiveness/imple-mentation unknown.	Not Applicable or minor activity/need.
24. Shoreline Erosion Plan	None, but needed; or exists, but poorly implemented; or shore-line extensively modified, little natural shoreline remaining; or severe shoreline erosion observed.	Plan is effectively implemented; shoreline restoration or erosion controls in place; low impact/innovative erosion controls used.	No plan and erosion levels unknown.	Have plan but effec-tiveness/imple-mentation unknown.	Not Applicable or low erosion levels

TABLE 3.4 SCREENING CRITERIA GUIDELINES FOR INSTALLATION EVALUATION

Vicinity Screening Criteria	IMPACT CATEGORY 1 Significant Existing or Potential Impacts		IMPACT CATEGORY 2 Impacts Poorly Defined or Unknown		IMPACT CATEGORY 3 Insignificant Impacts
	θ Significant Impact Potential (Adverse)	● Significant Impact Potential (Beneficial)	- Unknown/Poorly Defined Impacts (Adverse)	+ Unknown/Poorly Defined Impacts (Beneficial)	• Insignificant Impact Potential (adv. or bene.)
25. Shellfish Areas	Adjacent/on site and closed or beds significantly impacted due to on site activities.	Open/undisturbed and adjacent/on site.	Closed or impacted and within one tidal excursion; causes of observed impacts poorly documented.	Open or no observed impacts but within one tidal excursion.	None documented within last 10 years within one tidal excursion.
26. SAV Areas	Areas adjacent/on site recently disappeared and high probability of impact from site activities.	Areas adjacent/on site are re-establishing. Have SAV replanting program.	Areas within one tidal excursion; effects unknown/poorly defined.	---	None documented within last 10 years within one tidal excursion.
27. Fish Spawning/ Nursery Areas	Areas adjacent/on site are contaminated or habitat has been physically disturbed/ modified (i.e., dams, dredging, etc.).	Areas adjacent/on site are productive/undisturbed.	Areas within one tidal excursion; effects unknown/poorly defined.	---	None documented within last 10 years within one tidal excursion.
28. Wetland Areas	Areas adjacent/on site have been impacted, contaminated, or destroyed.	Areas adjacent/on site are productive/undisturbed, or wetland areas rehabilitated or re-established.	Areas within one tidal excursion; effects unknown/poorly defined.	---	None documented within last 10 years within one tidal excursion.
29. Waterfowl Nesting/ Wintering Areas	Areas adjacent/on site being disturbed or destroyed.	Areas adjacent/on site are undisturbed; and have habitat enhancement program.	Areas adjacent/on site; effects unknown/poorly defined.	---	None.
30. Endangered Species (ES)	ES habitat adjacent/ on site disturbed or destroyed; ES pop. decreasing.	ES habitat adjacent/on site enhanced; ES pop. increasing.	ES habitat adjacent/on site exist; effects of base unknown/poorly defined.	---	None.
31. Relative Impact on Tributary	Site contributes significantly to local pollutant stress or has high probability impact; site identified as problem area.	Site controls or reduces pollutants in areas of pollutant stress; local environment has shown positive response to clean up efforts.	Site contributions are unknown but likely high in areas of pollutant stress; or water quality status of receiving waters not known.	Site attempts controls but effects unknown in stressed areas; environment has improved, but cause is unknown/unclear.	Not Applicable; i.e., low level of pollutants, or site not on or near a tributary.

3.4 LITERATURE CITED

Commonwealth of Pennsylvania. 1985. Chapter 93. Water Quality Standards. Issued Under Sections 5 and 402 of the act of June 22, 1937 (P.L. 1987, No. 394). Department of Environmental Resources. Bureau of Water Quality Management. Harrisburg, PA.

Commonwealth of Virginia. 1986. Water Quality Standards. Adopted Pursuant to Section 62.1-44.15(3) of the Code of Virginia (1950), as Amended. Virginia Water Control Board. Publication No. RB-2-86. Revised Edition. Richmond, VA.

Environmental Protection Agency. 1983. Water Quality Standards Handbook. Office of Water Regulations and Standards. U. S. Environmental Protection Agency. Washington, DC.

______________________________ . 1985. Technical Support Document for Water Quality-based Toxics Control. Office of Water. U. S. Environmental Protection Agency. Washington, DC. EPA-440/4-85-032.

______________________________ . 1986. Quality Criteria for Water - 1986. Office of Water Regulations and Standards. U. S. Environmental Protection Agency. Washington, DC. EPA-440/5-86-001.

Horning II, W.B. and C.I. Weber, Eds. 1985. Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms. Biological Methods Branch. Environmental Monitoring and Support Laboratory-Cincinnati. U. S. Environmental Protection Agency, Cincinnati, OH. EPA/600/4-85/014.

Langbein, W.B. 1949. Annual runoff in the United States, Circular 52. US Geological Survey, Washington, DC.

Maryland. 1985. Code of Maryland Regulations 10.50.01. Subtitle 50 Water Management. Chapter 01 Water Quality and Water Pollution Control. Department of Health and Mental Hygiene. Baltimore, MD.

Mills, W.B., D.B. Porcella, M.J. Ungs, S.A. Gherini, K.V. Summers, Lingfung Mok, G.L. Rupp, G.L. Bowie and D.H. Haith. 1985. Water quality assessment: a screening procedure for toxic and conventional pollutants in surface and ground water. (Revised 1985). Prepared for the Center for Water Quality Modeling, Environmental Research Laboratory, Athens, Georgia and Monitoring and Data Support Division, Office of Water Regulations and Standards, Washington, DC. Volumes I and II. EPA/600/6-85/002a,b

Macknis, J. 1986. U.S. Environmental Protection Agency, Chesapeake Bay Program. Personal communication.

McElroy, A.D., S.Y. Chiu, J.W. Nebgen, A. A. and F.W. Bennett. 1976. Loading functions for assessment of water pollution from nonpoint sources. U.S. Environmental Protection Agency, Washington, DC EPA-600/2-76-151.

Mount, D.I., A.E. Steen and T.J. Norberg-King. 1985. Validity of Effluent and Ambient Toxicity Testing for Predicting Biological Impact on Five Mile Creek, Birmingham, Alabama. Environmental Research Laboratory. Office of Research and Development. U.S. Environmental Protection Agency, Duluth, MN. EPA/600/8-85/015.

Northern Virginia Planning District Commission, 1983. Chesapeake Bay Basin Model. Prepared for U. S. Environmental Protection Agency. Chesapeake Bay Program, Annapolis, MD.

Parker, C.A., et al. 1946. Fertilizers and lime in the United States. Miscellaneous Publication Number 586. US Department of Agriculture, Washington, DC.

Peltier, W.H. and C.I. Weber, eds. 1985. Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms. Third Edition. Environmental Monitoring and Support Laboratory-Cincinnati. Office of Research and Development. U.S. Environmental Protection Agency, Cincinnati, OH. EPA/600/4-85/013.

Pilli, A. and D.R. Gueldner. 1986. CETIS: Complex Effluent Toxicity Information System. Data Encoding, Entry, and Retrieval Procedures. Draft. Contract No. 68-01-7176-005. Computer Sciences Corporation, Falls Church, VA.

Russo. R.C. and A. Pilli. 1984. AQUIRE: Aquatic Information Retrieval Toxicity Data Base. Project Description, Guidelines, and Procedures. Environmental Research Laboratory. Office of Research and Development. U. S. Environmental Protection Agency, Duluth, MN. EPA/600/8-84/021.

Stephan, C.E., D.I. Mount, D.J. Hansen, J.H. Gentile, G.A. Chapman and W.A. Brungs. 1985. Guidelines for Deriving Numerical Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses. Office of Research and Development. Environmental Research Laboratories. U.S. Environmental Protection Agency, Duluth, MN/Narragansett, RI/Corvallis, OR. NTIS PB 85-227049.

Tetra Tech, Inc. 1986. Water Quality Assessment of DoD Installations/Facilities in the Chesapeake Bay Region: Phase I Report - Data Gathering and Installation Screening. Prepared for U. S. Army Corps of Engineers, Baltimore District, DACA 31-85-C-0168.

Vanoni, V.A., ed. 1975. Sedimentation engineering. American Society of Civil Engineers. New York. Wischmeier, W.H. and D.D. Smith. 1978. Predicting rainfall erosion losses - a guide to conservation planning. Agriculture Handbook Number 537. US Department of Agriculture, Washington, DC.

Wischmeier, W.H. and D.D. Smith. 1978. Predicting rainfall erosion losses- a guide to conservation planning. Agriculture Handbook Number 537. US Department of Agriculture, Washington, DC.

4.0 INSTALLATION EVALUATIONS BY TRIBUTARY/REGION

4.1 INTRODUCTION

Chapter 4.0 summarizes the installation assessments on a tributary/regional basis. For each Bay region, the environmental setting is presented along with a brief description of the major pollutant sources (point and nonpoint) which exist. A summary of DoD pollutant loads and impacts on water quality conditions in each region is also presented.

A number of topics are discussed in this introductory section as an aid to interpretation of the regional and installation results. Section 4.1.1 presents an overview of the historical and present environmental setting of the Bay which provides a background for the regional settings. Section 4.1.2 provides a synopsis of environmental trends in the Bay. Section 4.1.3 presents a regional breakdown of the DoD installations and gives a list of installations in the order of appearance in this chapter. Section 4.1.4 defines and describes typical activities on military installations which are frequently associated with known or potential environmental impacts on surface waters.

4.1.1 Overall Environmental Setting of the Bay

The Chesapeake watershed that drains into the Chesapeake estuary contains 64,000 square miles in several states including New York, Central Pennsylvania, Maryland, Delaware, Virginia, West Virginia, and the District of Columbia. The western watershed originates in the mountainous Appalachian Mountain Chain, and flows through the rolling Piedmont plateau to the Estuary which lies in the Coastal Plain. The eastern watershed is contained wholly within the Coastal Plain.

The Chesapeake estuary *per se* is defined by the limits of tidewater, at the "Fall Line" demarking the abrupt transition from the sedimentary Coastal Plain province to the rocky Piedmont province. This is the head of navigation for the subestuaries where major urban areas (Baltimore, Washington and Richmond) have developed. At the head of the Bay, the Conowingo hydroelectric dam stands on the Fall Line of the Susquehanna River, where the system changes from riverine freshwater to tidal freshwater.

The suspended and dissolved materials which enter the creeks and rivers within the drainage basin are eventually transported to the estuary. Most of the suspended materials are trapped in the estuary or subestuaries and are not flushed to the sea. Alternatively, the dissolved materials are flushed out to sea during the tidal cycles. With increasing utilization of the lands and waters, there is evidence that the estuary is being overloaded and unbalanced, with resulting loss of important natural resources.

The estuary mainstem has a 190 mile salinity gradient from freshwater at the head near the mouth of the Susquehanna River to polyhaline (nearly marine) at the Capes. The drainage basin consists of 150 rivers, creeks, and streams, with approximately 50 considered major tributaries. Six major rivers account for 90% of the freshwater diluting the Bay. The largest river, the Susquehanna, drains nearly 43% of the basin and contributes an average of 51% of the inflow. The York, Rappahannock, and James River systems drain nearly 25% of the basin and contribute 3%, 4%, and 14%, respectively, of the freshwater inflow. The Potomac, draining 22% of the basin, provides 18% of the total inflow. The Patuxent is the smallest of the major rivers draining only a little over 1% of the basin and contributing only 1.5% of the inflow.

The Upper Western Shore and Eastern Shore basins are composed of many streams and rivers, all of which have small discharges of freshwater. The larger rivers on the Upper Western Shore include the Severn, Magothy, Patapsco, Middle, Back, Gunpowder, and Bush Rivers. They collectively drain 2.5% of the basin and contribute 2.5% of the inflow. The flat, low discharge streams of the Eastern Shore include the Chester, Wye, Tred Avon, Choptank, Nanticoke, and Pocomoke Rivers. They collectively drain 6% of the basin and contribute 6% of the inflow.

The shores of the Bay are generally unconsolidated miocene sands, and subject to erosion. The few rocky outcrops are fossiliferous beds. The mainstem Bay trends north-south, and has essentially a shallow (20-30 ft) sandy or silty bottom, except in the reach from the Chesapeake Bay Bridge to the mouth of the Rappahannock, where a deep (80-100 ft) trench runs down the axis. The shoal near the Rappahannock gives the reach a semi-fjord like character, in which a strongly stratified two layer hydrographic system is established in the warmer months. This stratification is also typical of other portions of the Bay, from the estuarine transition near Poole's Island to the lower Bay, where lateral differences in salinity begin to dominate. The waters of the Bay are nearly isothermal in a given area in winter, but a pronounced thermocline is present in spring, summer, and early fall. The resultant density discontinuity is reinforced, in the upper Bay and mid-Bay reaches, by a layer of less saline waters, resulting in a halocline as well as a thermocline. Atmospheric oxygen does not readily mix through this discontinuity, resulting in oxygen poor or anaerobic waters in waters deeper than 20-30 feet during periods of stratification, particularly in summer months.

The Chesapeake Bay has sustained a highly productive biota until recent years. It has gained national prominence, especially for its harvests of oysters, soft clams, hard clams, blue crabs, and striped bass. The varied ecosystems in the estuary provide diverse functional habitats for many species, such as spawning and nursery habitat for important finfish and shellfish.

The estuarine resident anadromous or semi-anadromous fish, e.g., yellow perch, white perch and striped bass (rockfish), spawn during the spring in the tidal freshwaters, while the low salinity waters serve as nursery

areas. There is evidence that up to 40% of the striped bass along the Atlantic coast were spawned in the Bay. The anadromous American shad, hickory shad, blueback herring, and alewife spend their adult lives in the marine environment, but return to fresh water portions of the estuary to spawn, often above the Fall Line. Some marine spawning fish, e.g. menhaden, croaker (locally called hardheads) and weakfish spawn in the marine environment, but use portions of the estuary as nursery grounds. The blue crab hatches in the high salinity waters at the mouth of the Bay and the juvenile stages grow as they migrate up the estuary.

Ospreys and bald eagles are raptors that nest, and in the case of eagles, winter on the shores of the Chesapeake estuary. The presence of these birds is an indication that environmental quality of the Bay is improving, for the ospreys suffered severe population declines because of the widespread and careless use of toxic pesticides such as DDT. Since this compound was controlled, populations have rebounded. Bald eagles, however, are essentially shy birds, and will not nest in areas of significant human disturbance. With increased development on the estuary, nesting activity is threatened.

The Bay also serves as a major wintering area for swans, ducks and geese from the Atlantic Flyway. Millions of these waterfowl arrive each fall to feed on SAV, benthic molluscs, and on agricultural lands. They result in a large seasonal hunting oriented industry in the region.

The abovementioned fish and wildlife are the more visible manifestations of ecosystems in the estuary. Actually, there are many complex physico-chemical-biological interactions, often of relatively obscure chemicals and biota, that are of vital interest to the ecological as well as economic health of the Bay and its environs. These have been the subject of intensive studies.

4.1.2 <u>Environmental Trends in the Bay</u>

The Chesapeake Bay is unique, not only in its ecological composition, but also by the character of its local populace, reinforced by two and a half centuries of productivity, lore, and traditions. Consequently, when signs of ecological stress were confirmed in the late 1970's, unprecedented governmental and private resources were committed to diagnose and remedy the situation. All levels of social structure were involved including watermen, homeowners, local, State and Federal agencies, conservation groups, and academic institutions.

Studies on the Chesapeake estuary started before the turn of the century but were essentially local in nature until the post World War II era, when surveys of the Bay as an entity were initiated. In the mid-1960's and 1970's there was a movement of environmental awareness nationally, which increased attention on the ecological health of the environment. At that time, an assessment of the Chesapeake estuary revealed local pollution problems. This environmental concern helped produce enforceable water quality laws and resulted in passage (in early 1970) of major

legislation, including the Clean Water Act, National Environmental Policy Act (NEPA), Endangered Species Act (ESA), and the Clean Air Act.

In the late 1960's aberrations of the Bay system were demonstrated by widespread explosive growth of the exotic aquatic plant water milfoil, and extensive fish kills in the spring of the year, especially in the fresher portions of the estuary. After a few years, the milfoil died out, apparently from a natural viral disease. With the loss of milfoil, extensive blooms of blue green algae, primarily Anacystis sp., in the tidal freshwater and oligohaline waters of the Potomac estuary and the head of the Bay were experienced. These conditions have been improved by control of nutrients, mostly at point sources.

Other deleterious trends have become evident in the last decade: a Bay-wide loss of rooted aquatic plants (SAV); a loss of the anadromous spawning fishes (notably American shad), a decline in striped bass populations and reproductive success, oyster reproduction, and soft shell clam reproduction; and extensive changes in the habits of wintering water fowl.

Because of these concerns the EPA, in cooperation with many state and Federal agencies and academic institutions, commissioned surveys and studies of unprecedented scope, through the Chesapeake Bay Program, to evaluate the system. In this seven year study, information on the abovementioned environmental phenomena as well as data on nutrient and toxic loadings were compiled and evaluated, and long term trends of water quality data and observations were examined. Research was also conducted on SAV, nutrients, and toxics. Data analyses led to conclusions that there were: significant increases in the turbidity of the Bay (especially in the upper Bay); a significant increase in phosphorus and nitrogen; an increase in the scope and severity of oxygen depleted bottom waters in the trenches of the Bay; significant changes in development and population pressures on adjacent lands; and significant changes in adjacent agricultural practices. In this decade also, analytical technology had developed to make possible large scale observations on the distribution of heavy metals and anthropogenic (human originated) organic chemicals in the entire system. Areas characterized by high concentrations of such toxicants (i.e., urban centers) have been directly correlated to low species diversity and dominated by a few pollutant tolerant species.

The Chesapeake Bay is an important economic resource to the region. Its value as an important commercial shipping center and major link in the Intercostal Waterways has been demonstrated. Hampton Roads and Baltimore are two of the North Atlantic's five major port complexes. Industry projections indicate total cargo tonnage handled through Bay ports could double during the next 20 years. Other major industries located within the basin include steelmaking, shipbuilding, plastics and resin manufacturing, and chemical production. These commercial and industrial facilities, along with thousands of municipalities, use the Bay and its tributaries as sources of process water and outlets for treated waste.

The Bay's ability to support abundant and diverse populations of finfish and shellfish makes seafood harvesting and processing important elements in the economies of both Maryland and Virginia. The seafood industry, over 375 years old, provides thousands of commercial watermen with jobs harvesting fish, while onshore processing and distribution generates a number of secondary income opportunities. Oysters, blue crabs, soft shelled clams, and menhaden are the Bay's principal fisheries. Oyster and soft shell clam catches amount to approximately 50% of the nation's total production whereas blue crab production is one of the largest in the world.

Other important industries in the Chesapeake Bay region are sportfishing and boating, generating jobs and a significant portion of the revenue which sustains local economies. It is estimated that as much as one-third of the Bay's water-based contribution to the regional economy comes from sportfishing and related secondary spending.

Basin-wide, the population grew by nearly 50% or by 4.2 million between 1950 and 1980. Estimates of an additional 1.9 million by the year 2000 would result in a total of 14.6 million people. Although the largest increase will occur in the three largest basins, the Susquehanna, Potomac, and James Rivers, the highest rate of increase is expected in the York, Rappahannock, and Patuxent River basins. More people living within the Bay drainage basins results in additional stress on water quality due to increasing freshwater withdrawal, wastewater discharge, and recreation.

Land-use changes in the Chesapeake Bay basin have shown an increase (182%) in urban and residential usage and a decrease of 24% and 39% in cropland and pasture land, respectively. Forest land has increased slightly by 3.5%. The physical changes in land use will have a significant impact on the Bay.

The EPA has concluded that there have been significant deleterious trends in water quality in the Chesapeake Bay, and that changes in management practices are necessary to remedy the problems. These management practices include a wide array of both point (sewage and industrial outfalls) and nonpoint (urban runoff, agricultural runoff) controls, currently being implemented under the Chesapeake Bay Restoration and Protection Plan.

4.1.3 Regional Approach to DoD Installation Evaluation

A practical consequence of the EPA Chesapeake Bay Program [illegible] the recognition that environmental stresses and responses [illegible] in some areas of the Bay than in others. This [illegible] development of a segmentation scheme of the estuary, [illegible] physico-chemical and biological distributions. [illegible] characterization facilitates the regional grouping [illegible] 66 DoD installations under evaluation.

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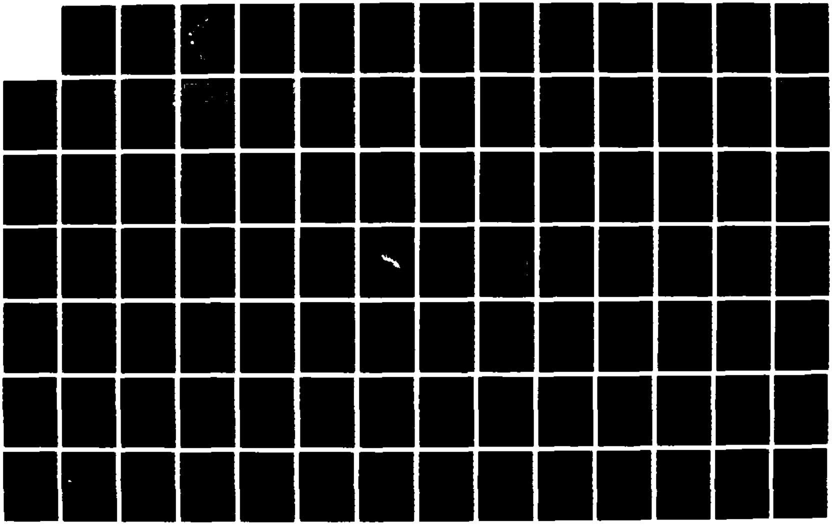

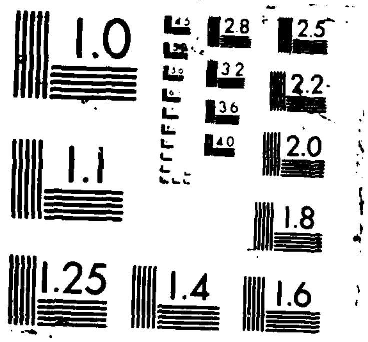
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Figure 4.1 shows the 13 major regions used to group the DoD installations. Each region is represented on separate more detailed maps presented for each regional discussion. Table 4.1 presents a breakdown of DoD installations by the various regions, and in the order in which they appear in Chapter 4.0. Table 4.1 also cross references the thirteen study regions to the CBP regions, where applicable.

Sections 4.2 through 4.14 of Chapter 4.0 present the DoD site evaluations organized by major region. An environmental setting is given at the beginning of each regional section to help identify the local significant ecological resources, water quality problems, and major pollutant sources in the vicinity of the respective DoD installations.

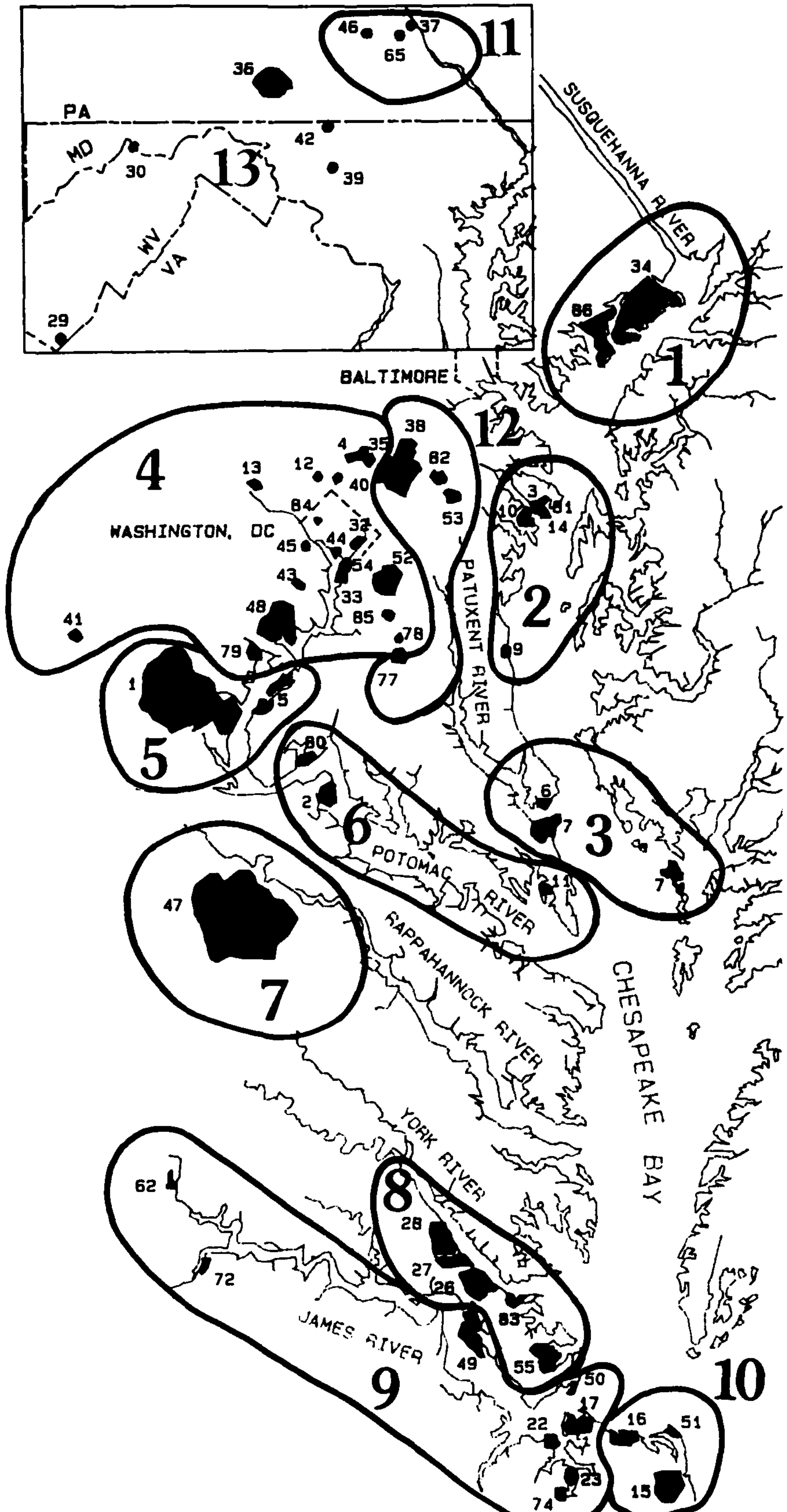
4.1.4 Common DoD Installation Activities

The Department of Defense has 38 major installations on or immediately adjacent to the Chesapeake estuary, and another 28 in the Chesapeake watershed, in riverine locations that feed the estuary. The number, size and distribution of these facilities indicates they are collectively a significant user of the estuary. Most DoD facilities are well established, dating from pre- World War II, and consequently have a history at least as long as the scientific observations on the Chesapeake Bay.

Department of Defense installations perform unique functions within the defense community in order to support the overall mission of national defense. A typical DoD installation is a community of people dedicated to performing a function for the military services. These functions are discussed for each installation in Sections 4.2-4.14 and range from providing office space and materiel support for a command headquarters to large industrial operations including manufacturing, maintenance, and repair. In all cases, however diverse the nature of the functions, the base must provide support for its resident and working populations, which range from several dozen people in the case of some remote sites with limited missions, to diverse populations approaching 100,000. The magnitude of the support functions varies considerably.

In supporting these functions and the personnel assigned to the bases there are a number of activities which are common and which, in varying degrees, have the potential to impact water quality in the vicinity of the base. In order to provide a better understanding of the various activities which may affect water quality this section will describe those activities and their potential to impact the environment.

Table 4.2 presents an alphabetical glossary of common activities found on most DoD installations, regardless of function, which have the potential to impact water quality. A brief description of each activity is given in the following paragraphs (in alphabetical order).



STUDY GROUP 1

34,86 Aberdeen Proving Ground
80 Harry Diamond Lab-Blossom Point
15 Naval Air Station - Oceana
7,8 NAS/NATC - Patuxent River
5 Naval Ordnance Sta.-Indian Head
23 Naval Shipyard - Norfolk
83 Naval Supply Center - Yorktown
26 Naval Weapons Station-Yorktown
17-21 Sewells Point Naval Complex

STUDY GROUP 2

30 Allegany Ballistics Lab
52 Andrews Air Force Base
62 Defense General Supply Center
48 Fort Belvoir
49 Fort Eustis
38 Fort Meade
55 Langley Air Force Base
36 Letterkenny Army Depot
16 Naval Amph. Base - Little Creek
27 Naval Sup. Cen.-Cheatham Annex
22 Naval Sup. Cen. - Craney Island
2 NSWC - Dahlgren
4 NSWC - White Oak
65 Navy Ships Parts Control Center
1 USMC/MCDEC - Quantico
41 Vint Hill Farms Station

STUDY GROUP 3

54 Bolling Air Force Base
78 Brandywine DRMO
77 Brandywine Rec. & Housing Annex
43 Cameron Station
28 Camp Peary
14 David Taylor NSRDC - Annapolis
47 Fort A.P. Hill
39 Fort Detrick
51 Fort Story
35 Harry Diamond Lab - Adelphi
6 Naval Air Sta. - Solomons Annex
11 Naval Elect. Sys. Engr. Act.
12 Naval Medical Command - NCR
29 Naval Radio Station-Sugar Grove
33 Naval Research Lab - Wash., DC
9 Naval Research Lab - CBD
3 Naval Station - Annapolis
37 New Cumberland Army Depot
74 St. Juliens Creek Annex
40 Walter Reed Army Medical Center
32 Washington Navy Yard

STUDY GROUP 4

46 Carlisle Barracks
13 David Taylor NSRDC - Carderock
53 Davidsonville RDV
72 Fort Lee
44 Fort McNair
50 Fort Monroe
45 Fort Myer
42 Fort Ritchie
79 Harry Diamond Lab - Woodbridge
85 Naval Communications Unit
84 Naval Observatory - Wash., DC
81 Naval Radio Transmit. Facility
10 U.S. Naval Academy
82 U.S. Naval Academy Dairy Farm

Figure 4.1 Regional Grouping of DoD Installations.

TABLE 4.1 REGIONAL GROUPING OF DOD INSTALLATIONS IN THE CHESAPEAKE BAY DRAINAGE AREA

CODE	SERVICE	INSTALLATION NAME	STUDY REGION	EPA CHESAPEAKE BAY SEGMENT
34,86	USA	Aberdeen Proving Ground	1. Upper Chesapeake Bay	RET-2
3	USN	Naval Station, Annapolis	2. Mouth of Severn River (Upper Central Bay)	
10	USN	U.S. Naval Academy		
14	USN	DTNSRDC - Annapolis		WT-7
81	USN	Naval Radio Transmitter Center		CB-4
9	USN	Naval Research Lab CBD		
7,8	USN	Naval Air Station/ Naval Air Test Center - Patuxent	3. Mouth of Patuxent River (Central Bay)	LE-1
6	USN	Naval Air Station - Solomons Annex		CB-5
4	USN	Naval Surface Weapons Center - White Oak	4. Tidal Fresh Potomac River	
12	USN	Naval Medical Command NCR		
13	USN	DTNSRDC - Carderock		
32	USN	Washington Navy Yard		
33	USN	Naval Research Lab		
35	USA	Harry Diamond - Adelphi		
40	USA	Walter Reed Army Medical Center		
41	USA	Vint Hill Farms Station		TF-2
43	USA	Cameron Station		
44	USA	Fort McNair		
45	USA	Fort Myer		
48	USA	Fort Belvoir		
52	USAF	Andrews Air Force Base		
54	USAF	Bolling Air Force Base		
78	DLA	Brandywine DRMO		
79	USA	Harry Diamond - Woodbridge		
84	USN	U.S. Naval Observatory		
85	USN	Naval Communications Unit		

TABLE 4.1 (Continued)

CODE	SERVICE	INSTALLATION NAME	STUDY REGION	EPA CHESAPEAKE BAY SEGMENT
1	USN	Marine Corps DEC - Quantico	5. Potomac River Transition Zone	TF-2
5	USN	Naval Ordnance Station - Indian Head		RET-2
2	USN	Naval Surface Weapons Center - Dahlgren	6. Potomac River Estuary	RET-2
80	USA	Harry Diamond - Blossom Point		LE-2
11	USN	Naval Electronics Systems Engineering Activity		
47	USA	Fort A.P. Hill	7. Rappahannock River	-
26	USN	Naval Weapons Station - Yorktown	8. York River Estuary	
27	USN	Naval Supply Center - Cheatham Annex		LE-4
28	USN	Camp Peary		WE-4
83	USN	Naval Supply Center - Yorktown		
55	USAF	Langley Air Force Base		
62	DLA	Defense General Supply Center	9. James River Estuary (Includes Hampton Roads and Elizabeth River)	
72	USA	Fort Lee		
49	USA	Fort Eustis		
50	USA	Fort Monroe		
17,18,19 20,21	USN	Sewells Point Navy Complex		LE-5
22	USN	Naval Supply Center - Craney Island		
23	USN	Norfolk Naval Shipyard		
74	USN	St. Julien's Creek Annex		
15	USN	Naval Air Station Oceana	10. Mouth of Bay	
16	USN	Naval Amphibious Base - Little Creek		CB-8
51	USA	Fort Story		
37	USA	New Cumberland Army Depot	11. Susquehanna River	Not Applicable
46	USA	Carlisle Barracks		

TABLE 4.1 (Continued)

CODE	SERVICE	INSTALLATION NAME	STUDY REGION	EPA CHESAPEAKE BAY SEGMENT
65	USN	Navy Ships Parts Control Center		
38	USA	Fort Meade	12. Non Tidal Patuxent River	Not Applicable
82	USN	Naval Academy Farm		
53	USAF	Davidsonville RDV		
77	USAF	Brandywine Receiver and Housing Annex		
36	USA	Letterkenny Army Depot	13. Non Tidal Potomac River	Not Applicable
39	USA	Fort Detrick		
42	USA	Fort Ritchie		
29	USN	Naval Radio Station - Sugar Grove		
30	USN	Allegany Ballistics Lab		

TABLE 4.2 COMMON ACTIVITIES ON DOD INSTALLATIONS

Agricultural Leasing Programs
Auto Craft Shops
Biomedical Research Laboratories
Bird Sanctuary Programs
Chemical Research/Testing Laboratories
Commissary/AFES Facilities
Confidence Courses
Drydocks
Fire Training Pits
Firing Ranges
Flightlines/Runways
Forestry Programs
Fuel Storage Facilities
Hazardous Materials/Waste Storage Facility
Heating Plants
Hospitals/Clinics
IRP/NACIP Confirmation Sites
Laundries
Mess Halls/Galleys
Motor Pools
Munitions Handling Operations
On-Base Housing
Parking Lots
Pesticide Storage/Handling Facilities
Photographic Laboratories
Refueling Operations
Repair Shops
Rework Facilities
Sanitary Landfills
Sewage Treatment Plants
Shoreline Erosion Control Programs
Stormwater Management Programs
Swimming Pools/Sand Pools
Vehicle Test Courses
Vehicle Wash Racks
Water Treatment Plants
Wetlands Management Programs
Wildlife Management Programs

Agricultural Leasing Programs - Many installations are located on large tracts of land, some numbering in the tens of thousands of acres. On such bases it is a common practice to lease some land to local farmers for growing crops. The land is then used in a way that is compatible with the service's mission, without undue conflicts, while generating revenue for the installation. In most cases the bases require that the farmers use best management practices in preparing the land for the crops and in this way ensure that minimal topsoil is lost and that sediment contribution to neighboring bodies of water is minimal. If the farmer chooses to use no-till methods as a means of soil conservation he will, of necessity, use herbicide and insecticide treatment of the fields to prepare for planting and during the growing season. This presents a hazard to the nearby aquatic life if there is a spill, if the farmer exceeds the recommended application rate or if proximity to surface waters allows direct runoff from fields after rain. Groundwater can also become contaminated with pesticides and fertilizers in certain soil types. In addition to herbicide and insecticide usage it is common practice for farmers to apply some form of nutrient enrichment to the soil to aid in crop growth. The common form of nutrient application is a liquid containing combinations of nitrogen, potash, and phosphorous. Other applications of nutrients occur in solid form, in the form of liquid or solid manure, or as land application of sewage sludge. In all cases, although not to an equal degree, a potential exists for nutrient rich runoff to enter nearby bodies of water.

Auto Craft Shops - As part of a base's support of its military personnel, auto craft shops are areas set aside on base where the military personnel can perform routine maintenance and repair of their privately owned vehicles (POV's). Typically, the base auto craft shop can accommodate most forms of vehicle repair from changing oil and lubricating to rebuilding engines and making major structural repairs. Automobile painting may or may not be allowed in the auto craft shop. Without a progressive education program and a strict monitoring program, it can be expected that oil, grease and solvents as well as paint will be major constituents of runoff from these areas Most installations are aware of these hazards to the environment and provide oil/water separators for the effluent or pass the drainage from the shop directly to the sanitary sewer.

Biomedical Research Laboratories - Some installations in the Chesapeake Bay drainage basin have biomedical research laboratories. These facilities generate unique hazardous wastes which must be disposed of appropriately. The wastes generated range from metals such as silver, to solvents and antiseptics, to virulent pathogens and carcinogens. There are no facilities in the region which are actively carrying on biological warfare research, however, the capability exists within the drainage basin and could be implemented if necessary. Hazardous wastes from these facilities are usually removed by contract as with other hazardous wastes. Several facilities have either currently permitted disposal sites or have historically disposed of infectious wastes in onsite landfills.

Bird Sanctuary Programs - Many bases with large undeveloped tracts of land may have instituted, as a part of their wildlife management efforts, a bird sanctuary program which leaves large areas of land in its natural state. This has a positive impact on the aquatic environment.

Chemical Research/Testing Laboratories - The mission of some of the installations or their tenants is related to the development of chemical warfare techniques and materiel. The activities which are taking place at any given time are usually classified and will not be addressed in this study. The nature of the mission, however, is evidence that highly toxic or exotic materials are handled at these facilities and any failure in the treatment of the wastes from such an operation puts water quality in the area at risk.

Commissary/AFES Facilities - Another aspect of providing services to the military personnel on an installation is that of having retail stores, snackbars, and grocery stores. These facilities on a military base have the same potential impact on the environment as, say, a shopping center or mall would have in a small town. Parking lots must be provided for patrons, and garbage and other wastes are generated. This may contribute, however insignificantly, to an installation's impact.

Confidence Courses - Military readiness of the installation is primary to its existence. On confidence courses, sometimes referred to as obstacle courses, the military personnel take their physical training and maintain their military skills. Most confidence courses are well maintained but continual usage may destroy much vegetative cover and provide the opportunity for soil erosion and hence for sedimentation problems to gain a foothold.

Drydocks - The services, and in particular, the Navy, have the need to perform ship hull maintenance and so must use drydocks for access to the submerged portions of the hulls. The nature of the work performed in drydocks, i.e., sandblasting, welding, painting, etc. and their proximity to the water makes them a subject of concern for water quality. The term drydock can be applied to any method of removing a ship from the water and can be of any size. The areas used to scrape, sand and paint the racing sailboats of the U.S. Naval Academy can be regarded as drydocks as can the floating drydocks at Sewells Point or Little Creek and the huge drydocks designed to accommodate aircraft carriers at the Norfolk Naval Shipyard.

Fire Training Pits - It is imperative that an installation be self sufficient in fire fighting and disaster preparedness. Most bases have their own fire fighting unit, some on a larger scale than others. In years past it was the habit of the unit responsible for fire fighting training of military personnel to simulate disasters by dumping old solvents, oils, greases and other waste flammable materials in a designated pit where they were ignited and subsequently extinguished in training exercises. These pits exist on most installations but are

usually no longer used. The potential hazard from the fire training pits comes from the types of materials which were used in the past for fuel. Groundwater contaminatic. is common and if toxic or hazardous materials were used for fuel there is a potential for affecting nearby aquatic environments.

Firing Ranges - In providing an area for weapons testing or for target practice, an installation can have a dual impact on water quality. By providing an area that must remain untouched by virtue of the fact that there is a physical danger in entering from unexploded ordnance and from incoming shells, the installation has a positive impact on water quality. At the same time, if heavy artillery or live bombing destroys existing vegetation, it may promote or exacerbate erosion or sedimentation problems, or if it is marshland, it may destroy a source of detrital food or essential habitat.

Flightlines/Runways - Flightlines and runways create impacts from basically the same areas as roadways and parking lots but on a much larger scale. Along with the normal leaching of chemicals from the surface there is the ubiquitous problem of grease and oil and of accidents and crashes. The problems are greater with runways and flightlines because of the scale of their traffic. An aircraft accident creates considerably more problems than an automobile accident especially when the aircraft is loaded with ordnance or other hazardous cargo. In addition, oil spills are much more prevalent on the flightline because of the method of fuel transfer, from truck to plane, than on a parking lot. At the same time, the military is much more able to cope with the accidents and spills and can often minimize environmental damage with superior response time and technology.

Forest Economic Programs - Like agricultural leasing programs, forestry programs make use of existing undeveloped portions of the installations. Unfortunately, as with the agricultural leasing programs the forestry programs are a mixed blessing. The most economical production of wood comes from the quick turnover of pine forests which are planted on a rotational basis and then clearcut for either pulp or for lumber. The nature of logging an area may create sedimentation problems both from the exposure of unvegetated land and from the disturbance of the ground by heavy tree moving equipment. If the operation is performed correctly and with reasonable care, logging operations can be relatively clean. However, proximity to streams increases the chance for sediment and other deleterious runoff. The installation is dependent upon the logging contractor to exercise care and to implement the necessary soil erosion and sedimentation measures.

Fuel Storage Facilities - There are, as with each of these common features, widely varying degrees of fuel storage on the installations. The uses for the fuel are many. Some installations' primary function is the storage and transfer of fuel requiring the storage of millions of gallons, while others store fuel solely for use in the base motorpool or for heating small buildings. The method of storage varies as greatly as the amount of fuel that is stored. Some fuel is stored above ground in

steel tanks with bermed or diked areas for spill containment. Other installations store fuel underground in old concrete tanks. The method and amounts of fuel storage and transfer are critical considerations in the preliminary screening procedure and when deemed necessary are discussed in the detailed evaluations.

Hazardous Materials/Waste Storage Facility - Ideally, each of the facilities that uses hazardous materials or that generates hazardous waste should have a storage area which conforms to the criteria set forth in 40 CFR. These guidelines specify the arrangements which must be made when storing any of the hazardous materials listed in the regulations.

Heating Plants - Heating an installation can cause water quality concerns in both the operation of the heating plant and in the distribution system. In the operation of a heating plant a number of areas cause some water quality concerns. Fuel storage areas associated with firing the boilers at a heating plant can range from oil storage tanks to coal storage yards and combustible trash. Each of these types of fuel has its own set of hazards from spillage to acid runoff. Blowdown water may require pH modification, filtration, or other special treatment before being discharged to a stream, as can the condensate water from steam heating.

Hospitals/Clinics - The obvious hazard from clinics and hospitals is the presence of infectious agents in both the solid and liquid wastes generated there. These can be present in the sewage effluent, the graywater, or in solid wastes such as bandages or operating room wastes. In addition, a hospital's effluent can have high BOD levels, solvents, antiseptics and pesticides.

IRP/NACIP Confirmation Sites - The Army's and the Air Force's Installation Restoration Program (IRP) and the Navy's program entitled Navy Assessment and Control of Installation Pollution (NACIP) are DoD's version of Superfund and are designed to identify and assess the potential impacts of former hazardous waste disposal areas. Typically, an IRP or NACIP report will research all available records of past disposal practices as well as historical records of industrial operations on an installation and determine from those whether it is possible that hazardous wastes were dumped on base. If sites are found to be possibly contaminated, and that they pose a threat to health and the environment from materials migrating out of that site in either surface or groundwater, a confirmation study is performed to assess the degree of contamination from the site and to recommend remedial measures.

Laundries - The use of chlorine bleaches, dry cleaning solvents, or non-biodegradable detergents in laundry operations presents some hazard to water quality. The discharge of steam condensate from pressing operations may also degrade local water quality. Hospital laundries have their own special problems with infectious waste disposal.

Mess Halls/Galleys - Feeding large numbers of people at an installation produces solid waste disposal problems. Holding garbage for long periods of time or some inevitable spillage from dumpsters may cause high BOD levels and subsequent low DO concentrations in the storm drainage system which services a dining facility. This can either result in direct discharge of low DO/high BOD water into the nearby receiving water or may overload a treatment plant during times of peak discharge.

Motor Pools - Each installation will usually have its own transportation facility which, depending on the mission, may range from several pickup trucks or automobiles to large fleets of heavy trucks. The maintenance performed on these vehicles usually produces oil and grease, degreasing compounds, steam cleaning residues, and paint and metal residues, which if not carefully contained and handled, can enter the storm drain system and subsequently cause water quality problems near the installation.

Munitions Handling Operations - The nature of the armed services requires that most of the installations store or handle munitions of some kind, from the storage of small arms ammunition to the manufacture of chemical, biological and radiological weaponry. The hazards to the environment vary with the types of munitions. Munitions handling also includes the firing of ordnance at test ranges or at disposal sites. The effects of explosive wastes and unexploded ordnance on the environment are not well known and the risks of toxicity are therefore not easily assessed.

On-Base Housing - Residential housing units present a great range of problems from sanitary sewage to the improper disposal of household chemicals and to residues from maintaining the family automobile.

Parking Lots - Creating space for base personnel to park their personal cars or for storage of base vehicles can contribute oil, grease and other residue from the automobiles but also provide large areas of impervious surface which must be drained during storms and may tax stormwater distribution systems as well as introduce contaminants into adjacent surface waters.

Pesticide Storage/Handling Facilities - The use of toxic pesticides to control noxious insects and weeds on an installation is a universal practice. With properly trained personnel making the applications and with storage areas which conform to health and safety guidelines there is little concern for water quality hazards. Spills, improper storage, and overuse of pesticides can, however, be damaging. Most bases either have trained personnel to administer pesticides or arrange for this function to be handled by a certified pest control contractor.

Photographic Laboratories - Most installations will have a base photographic laboratory for military use and will sometimes have a photographic hobby shop for the use of base personnel. The use of chemical preparations and fixing baths and the disposal of these can produce residues of silver and chromium and create pH balance problems in the effluent. Technologies exist and are in use at some installations for

effective treatment of the wastes and for the economical recovery of silver residues.

Refueling Operations - The magnitudes of refueling operations on the installations vary as widely as their missions. The principal hazard to water quality from refueling operations is major spills of petroleum, oils and lubricant (POL) products directly into the nearby surface waters, however, there are other hazards associated with the storage and handling of POL products on base. The storage tanks on many of the bases are World War II vintage or older and may leak. The Underground Storage Tank (UST) problem has been addressed on a number of bases in response to provisions of the Resource Conservation and Recovery Act (RCRA) but most programs are still ongoing or not yet implemented and the effects of UST's are largely unknown. The same problem may be evidenced in fuel distribution systems which use underground lines. Unless a specific study is undertaken to determine if there is a UST problem the only evidence may be some form of environmental degradation.

Repair Shops - The maintenance and repair of equipment is ubiquitous in DoD and, as with most of these common activities, varies in magnitude from an area designated for degreasing and servicing engines to full industrial operations encompassing an entire base. The most common repair shops on a base are the small engine repair shops, plumbing shops, paint shops, communication equipment repair shops and others which are normally needed for the upkeep of the base. It is the drainage from these shops and their surrounding areas which may cause water quality concerns. Many repair shops use solvents, oil, grease and otner chemicals in their day-to-day operations and minor spills and improper disposal are common.

Rework Facilities - The need for the rework of aircraft, ships, military vehicles, and other weaponry requires that some of the installations have rather extensive industrial operations which include large scale stripping, painting, sandblasting, smelting and welding facilities. Many of these operations have the need for industrial pretreatment plants which can remove some of the toxics from the wastewater and adjust for pH before it is sent to a sewage treatment plant. Most of the larger rework facilities are equipped with such pretreatment, however, their effectiveness is variable.

Sanitary Landfill - Much of the solid waste disposal on DoD bases is done by contract and removed to permitted landfills in the area. There are a few bases remaining which still have permitted landfills although the tendency has been to end the use of on-base sanitary landfills. The on-base landfills which are in use present a number of water quality hazards. The types of materials which are deposited there are diverse and can range from asbestos debris through clinical wastes to STP sludges. Leachate and surface runoff from these landfills can contribute toxics, oil and grease, infectious wastes, coliform bacteria, and other constituents to the detriment of the aquatic environment.

Sewage Treatment Plant - Sewage treatment in the DoD is an area where much progress is being made toward a cleaner environment. Most of the STP's on DoD installations have secondary or tertiary treatment and some include nitrification and other AWT features. This compares favorably with many municipal plants which can only provide primary treatment. The DoD has a significant capital investment in its waste treatment facilities.

Shoreline Erosion Control Programs - It is in the best interest of the DoD installations to halt shoreline erosion when economically feasible to prevent the loss of valuable land. Most bases have some form of coastal protection works which prevents erosion. These protection works may be in the form of bulkheads, revetments, groins, or jetties which essentially prevent the removal of land from the base. In some areas however it is not possible to bulkhead an area where there are wetlands or marshes, and other desirable approaches may be used, such as vegetative planting or dune construction.

Stormwater Management Programs - The State of Maryland is the only jurisdiction which requires a base to have a stormwater management plan incorporated in its master plan. This is aimed at controlling storm runoff flows and contaminants discharging into the Chesapeake Bay during periods of above average rainfall. The federal installations' implementation of stormwater management plans has generally been less emphasized than other programs.

Swimming Pools/Sand Pools - In providing for the recreational enjoyment of base personnel, swimming pools and sand pools are usually provided on base. The backwash from these systems can have quite high levels of residual chlorine or of coliform bacteria. Swimming pool and sand pool effluent should either be treated before release into surface waters or be discharged into the sanitary sewer system.

Vehicle Test Courses - Testing vehicles is performed on a number of installations in the Chesapeake Bay Region. The vehicles range from jeeps and trucks to tanks to amphibious landingcraft and hovercraft. The testing often causes destruction of the vegetation and so creates the potential for increased erosion and sedimentation.

Vehicle Wash Racks - The washing of motor vehicles is usually done in designated areas where the washwater can be collected and treated for removal of waste POL products via an oil/water separator. The oil/water separator however does not provide for the removal of any detergents or emulsifiers which may be used to aid in washing. Vehicle wash racks generally discharge into the nearby surface waters, however, a few discharge into sanitary sewer systems which is preferable.

Water Treatment Plants - Each base has the need for potable water and although many obtain water from the local municipal supply, some have their own treatment plants which use chemicals to remove iron and other metals and to remove bacteria which may be present in the raw water. The water treatment plants must periodically backwash their flocculators

or settling tanks and often use settling ponds to provide primary treatment to the backwash water. The sludge which settles from the backwash is usually rich in iron and if discharged directly into the surface waters would present a water quality problem.

Wetlands Management Programs - The majority of wetlands management programs on DoD installations are policies of non-use. Any management programs dealing with the wetlands on the bases are usually the promotion of wildlife habitat which more appropriately falls under the category of wildlife management programs. Few bases have aggressive wetlands management programs which actually promote the growth and development of wetlands. Aggressive programs would involve, for example, the burning off of old vegetation to provide nutrients and growth of new vegetation, or marsh grass planting projects. Also, wetlands management must include careful consideration of local water quality impacts, since productive wetlands are strongly dependent on the quality of the intertidal waters.

Wildlife Management Programs - The management of wildlife on a base presents possibilities of innovative techniques of managing population dynamics and providing optimum habitat and browse for various ecosystems, however, the time and effort involved in this type of management does not return sufficient gains to warrant allocations of specialized personnel to the task. Most bases therefore have what must be termed as incidental wildlife management programs.

4.2 REGION 1: UPPER CHESAPEAKE BAY

4.2.1 Tributary/Regional Description

4.2.1.1 **Environmental Setting**. The Susquehanna River basin is the largest drainage area in the Bay catchment area (see Figure 4.1). The lower basin drains the Piedmont Region. The confluence of the Susquehanna River with the Chesapeake Bay is at Havre de Grace, and 12 miles further upstream is Conowingo Dam, a hydroelectric facility. The mean tidal range is 1.8 feet at Havre de Grace. Water depths in the upper Bay range from the shallow (1 to 3 feet) but ecologically significant Susquehanna flats, to generally 10-20 foot depths in the Bay. The shipping channel is dredged to 35 feet. The sediments are generally more than 50% quartz sand, with coarser fractions in the high energy zones and finer fractions in the deeper spots. Because of the relatively shallow depths, the bottom sediments are easily resuspended by wind, contributing to the high turbidity in the area.

This region of the Bay is probably the most environmentally sensitive because of its role as a finfish spawning and nursery area, and as a major wintering ground for migratory waterfowl.

The Susquehanna Flats were renowned for the huge aggregations of wintering waterfowl. Historically, the northern bay area, with its abundance of shallows and SAV was replete with most of the species of

waterfowl in the Atlantic flyway. As recently as 1962 it was stated that "The huge flocks of canvasbacks sometimes contain nearly half of the total continental population of the species." With the loss of nearly all of the SAV in the 1970's, the overwintering waterfowl populations that were dependent upon these plants were also dramatically reduced in this area.

The head of the Bay has long been known for the annual spring run of American shad, but this resource has completely disappeared in the past decade. American shad are "channel spawners", compared to other migrating clupeids (blueback herring, alewife, hickory shad) that spawn in the small freshwater tributary streams. Access to upstream spawning areas has been blocked by Conowingo and other dams on the Susquehanna.

The waters of the upper Bay are also extremely important for the resident but anadromous species of yellow perch, white perch, and striped bass. These fish spawn in the fresh water reaches, and the oligohaline (brackish) reaches serve as the primary nursery areas.

During the 1970's, the upper Bay tidal freshwater tributaries experienced massive blue-green algal blooms; a condition denoting accelerated eutrophication. This area was also the first to lose its SAV, which have subsequently declined over most of the Bay, especially on the Western shore. The upper Bay area has also been identified as being overenriched with nutrients, and as having high concentrations of heavy metals, anthropogenic organic compounds, and particulates (turbidity).

Aberdeen Proving Ground (APG), consisting of the Aberdeen and Edgewood Areas, is the only DoD installation operating in the Upper Chesapeake Bay region (see Figure 4.2). The surrounding area is primarily undeveloped, with woodlands, agriculture, and some small communities nearby. Surrounding waters, while tidal, are essentially fresh. Several creeks and small tidal tributaries are associated with this complex. They include Swan Creek, Romney Creek, Bush River, and, south of the Edgewood Arsenal, the Gunpowder River and its creeks. Extensive freshwater marshes are found on the Aberdeen Area, especially along the tributary creeks on the Bay side.

4.2.1.2 Vicinity Pollutant Loadings

Vicinity Point Sources. There are 22 municipal sewage treatment plants (STPs) currently discharging to the Upper Chesapeake Bay region as shown in Figure 4.2 and Table 4.3a. These STPs have a combined average discharge flow of 14 MGD, including the Aberdeen and Edgewood STP flows of 1.6 MGD. The above discharges do not include, however, the significant sewage discharges from the City of Baltimore in the Patapsco River area, which is just south of this region.

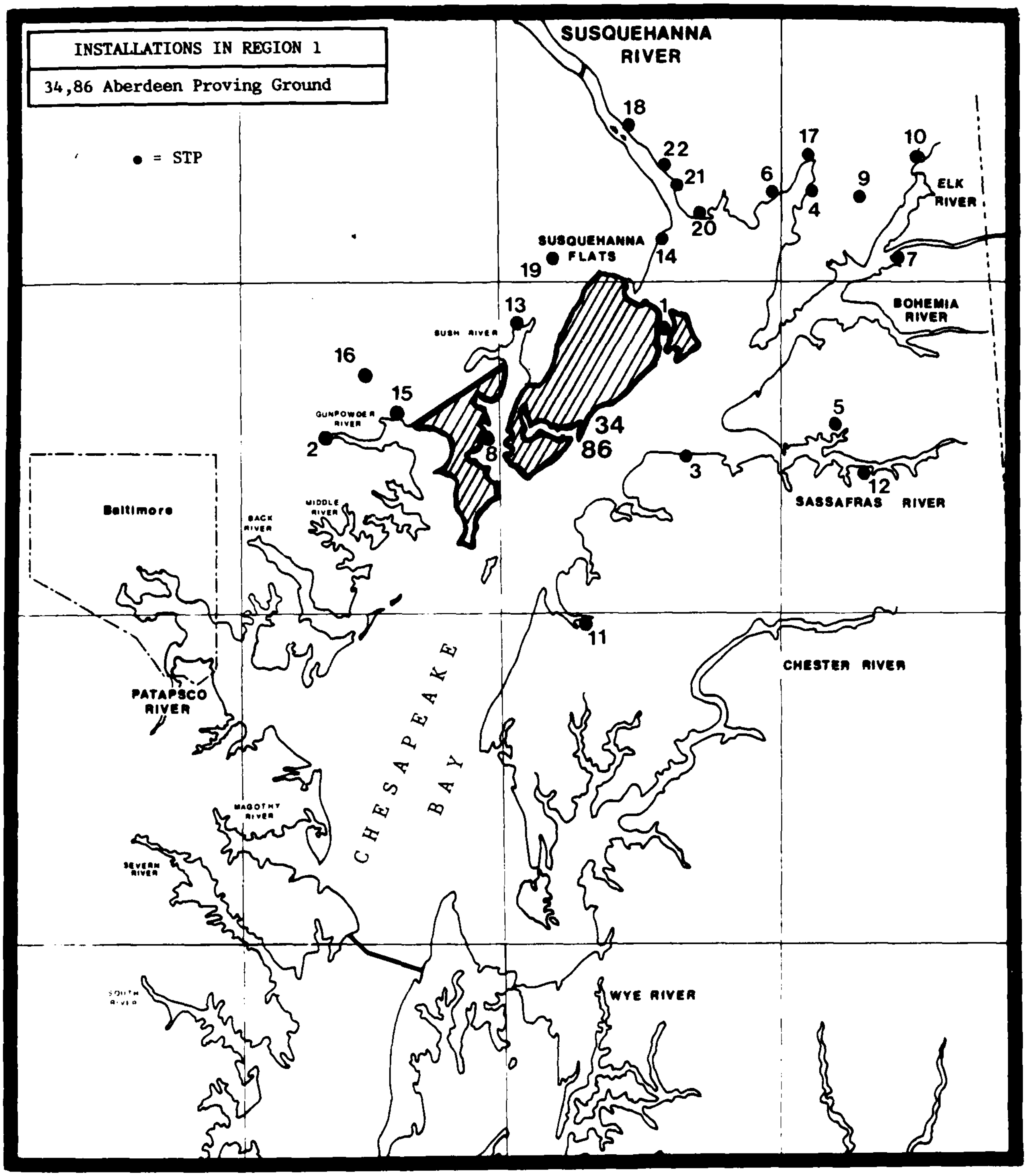


Figure 4.2 Region 1 - Upper Chesapeake Bay

Table 4.3a Comparison of Point Source Conventional Pollutant Loadings to the Upper Chesapeake Bay*

Code	NPDES	Name	BOD5	NH3	TKN	TN	PO4	TP	TSS	MGD
1	21237	Aberdeen Wastewater Treat Facility	51.73	20.443	51.82	136.28	4.361	9.691	44.80	1.3263
2	22713	Baltimore City Dpw Richlyn Manor	14.60	7.889	9.62	10.81	3.972	4.673	14.60	0.0700
3	20575	Betterton, Town Commissioners of	10.43	5.635	6.87	7.72	2.837	3.338	10.43	0.0500
4	52825	Cecil Cnty Dept Pub Wks	6.26	3.381	4.12	4.63	1.490	1.752	6.26	0.0300
5	20443	Cecilton, Town of	8.35	4.508	5.50	6.18	2.270	2.670	8.35	0.0400
6	21067	Charleston	37.55	20.286	24.73	27.79	10.214	12.017	37.55	0.1800
7	20397	Chesapeake City, South Plant	25.04	13.524	16.49	18.53	6.810	8.011	25.04	0.1200
8	21229	Edgewood Arsenal	47.07	28.995	73.50	193.30	4.588	10.196	54.47	1.3386
9	23833	Elk Neck State Park	2.09	1.127	1.37	1.54	0.567	0.668	2.09	0.0100
10	20681	Elkton Stp	329.54	99.896	140.35	145.95	13.659	22.765	475.50	0.8800
11	53333	Fairlee Stp	8.35	4.508	5.50	6.18	2.270	2.670	8.35	0.0400
12	20605	Galena, Town of	2.09	1.127	1.37	1.54	0.567	0.668	2.09	0.0100
13	21709	Harford Cnty Dept Pub Wks Sod Run	825.74	133.155	337.33	887.70	21.250	47.222	704.32	5.7500
14	21750	Havre de Grace WWTP	2680.52	176.715	267.75	267.75	40.744	90.543	917.53	1.5500
15	22535	Joppatowne	51.45	33.966	47.18	69.74	34.136	40.160	70.63	0.6875
16	27405	Md Correction Center	98.05	52.969	64.58	72.56	23.337	27.455	98.05	0.4700
17	22594	Northeast River	106.40	57.477	70.07	78.74	27.132	31.920	106.40	0.5100
18	20265	Rising Sun, Town of	35.47	19.159	23.36	26.25	9.647	11.349	35.47	0.1700
19	24953	Spring Meadows Wstwtr Treat Plt	2.09	1.127	1.37	1.54	1.567	0.668	2.09	0.0100
20	20613	Town Commissioners of Perryville	64.49	70.155	85.53	96.10	5.715	7.623	73.71	0.6225
21	20796	Town of Port Deposit	29.21	15.778	19.24	21.61	1.490	1.752	29.21	0.1400
22	23337	Woodlawn Park Stp	4.17	2.254	2.75	3.09	1.206	1.419	4.17	0.0200
		Total Upper Chesapeake Bay Region	4440.66	774.072	1260.39	2085.53	218.830	339.231	2731.08	14.0248

* Based on summer 1984/1985 conditions reported by USEPA (J. Macknis, Personal Communications)

Table 4.3 presents estimates of metals from point sources (STPs) by county into the Upper Chesapeake Bay (EPA, 1982). It can be seen that the majority of the point source metals loadings come from the Baltimore County/City area. These loadings are primarily from industrial waste treatment plants.

Table 4.3 Estimated Loadings of Metals to the Upper Chesapeake Bay*
Loadings (lbs/day)

County	Cr	Cd	Pb	Cu	Zn	Fe
Cecil	3.6	0.0	1.2	1.8	5.4	0.0
Kent	1.2	0.0	0.6	0.6	1.8	4.2
Harford	18.1	1.8	4.8	9.7	21.2	39.3
Baltimore	360.0	145.8	105.8	535.2	357.4	1361.4
Baltimore City	762.7	871.5	214.1	349.6	921.1	11878.2
Anne Arundel	48.4	2.4	33.3	35.1	67.7	188.7
Subtotal (Point Sources)	1194.0	1021.5	359.8	932.0	1374.6	13471.8
Atmospheric	-	1.5	17.1	14.1	416.0	43.9
Urban runoff	15.1	10.6	167.8	13.6	95.3	1477.2
Upstream at Fall Line	2316	393	1052	2359	5062	1.16×10^6
Subtotal (Nonpoint Sources)	2331.1	405.1	1236.9	2386.7	5573.3	1.16×10^6
Total	3525	1426.6	1596.7	3318.7	6947.9	1.17×10^6

* EPA (1982)

Vicinity Nonpoint Sources. The Susquehanna River basin is the largest drainage area in the Bay catchment area. The Susquehanna River accounts for an estimated 70% of the total nitrogen, 56% percent of the total phosphorus, and 40% of the total sediment load to the entire Chesapeake Bay (EPA, 1982). The confluence of the Susquehanna River with the Chesapeake Bay is at Havre de Grace, less than five miles north of APG.

Nonpoint sources of metals to the Upper Chesapeake Bay Region include atmospheric deposition, urban runoff, and upstream loadings from the Susquehanna River. Table 4.3 presents estimates of metals loadings from nonpoint sources (above the Fall Line) to the Upper Chesapeake Bay. There currently are no similar estimates of nonpoint source loadings of toxics to the Upper Bay.

4.2.1.3 Relative Comparison to DoD Installation Pollutant Loads

Point Sources - The Aberdeen and Edgewood STP discharges are located at the head of the Bay as shown in Figure 4.2. The APG sewage treatment plants represent approximately 2% of the BOD and 10% of the nutrient loads to this area from point sources, excluding Baltimore City discharges. Although it was not possible to estimate the metals loadings from APG discharges, it is suspected that these are minor in comparison to the total metals loadings from vicinity point sources based on the low percentage of flow and conventional pollutants contributions. Due to a lack of information on toxics, a comparative analysis for APG cannot be made.

Nonpoint Sources - In terms of nonpoint source contributions, APG contributes an insignificant loading of conventional pollutants (nutrients, BOD, suspended solids) to the Upper Bay, compared to the surrounding contributions. Based on land surface area, for example, APG represents far less than 1% of the total Susquehanna River drainage area (including above and below the Fall Line). Despite the large surface area of APG, the contributions of nonpoint source conventional pollutants are relatively insignificant, partially due to the fact that the majority of APG (90%) is undeveloped.

Other potentially more significant nonpoint sources from APG involve the release of toxic contaminants from widely scattered ordnance, past chemical discharges, runoff from munitions demolition/burn areas, and landfill leachate. These sources are poorly characterized, however, as are the amounts of toxics in vicinity nonpoint sources, preventing any quantitative comparative analysis to be made.

4.2.1.4 **Summary of DoD Impacts on the Upper Chesapeake Bay**. APG is an exceedingly complex installation, and it is difficult to determine with confidence the level of environmental impact on surface waters based only on existing information. Overall, however, APG does not appear to have a significant impact on the Upper Bay region. Rather, conditions in this region are dominated by pollutant and sediment loads entering from the Susquehanna River. APG's influence, other than the contamination of open water areas by ordnance shells, appears to be confined to the creeks and waters directly on or adjacent to APG. The primary area of concern at APG involves the existence of several past sources of toxic contaminants from the munitions and chemical research and testing activities which could be discharging into the local tidal creeks and wetlands throughout the installation. Available water quality data indicate the presence of toxics above chronic toxicity threshold levels for the protection of aquatic life in certain tidal creeks. Key recommended actions for this installation therefore include expansion of monitoring activities specifically designed to detect the presence of chemical agents indicative of the type of activities that have occurred at APG. The following section summarizes findings and recommendations for APG.

4.2.2 Installation 34: Aberdeen Proving Ground
Installation 86: Edgewood Area

4.2.2.1 General. APG is located in Harford County, Maryland, near the Head of the Chesapeake Bay on the western shore, as shown in Figure 4.2. The reservation (Aberdeen Area and Edgewood Area) comprises approximately 80,000 acres, nearly half of which is open water. APG is a Test and Evaluation Command (TECOM), within US Army Material Development and Readiness Command (DARCOM), consisting of six directorates and 38 tenant activities. Research functions include broad based multidisciplinary programs of scientific research and advanced technology testing, and evaluation directed toward new and improved materiel, equipment, techniques, systems, and related operational procedures for the Army.

4.2.2.2 Summary of Impact Potential and Recommended Actions. In Phase I of this study, APG was screened in Study Group 1, based on the installation's location adjacent to prime Chesapeake Bay resources and the known but poorly defined presence of toxic or potentially toxic contaminants in local APG waters. The installation assessment methodology was applied to APG during Phase III to better define the likely character and extent of APG's impact on local receiving waters. As a result of this assessment, APG remains in Study Group 1 (see Table 4.4). Table 4.5 summarizes the areas of concern and recommended actions identified for APG. As shown in this table, areas of concern include: the potential existence of toxics in the Aberdeen STP effluent; stormwater runoff into local wetlands from uncontrolled munitions testing and detonation areas; contamination of large areas of aquatic habitat with millions of rounds of unexploded ordnance and duds; the existence of a white phosphorus deposit in a tidal flat area near Spesutie Island; and the existence of toxic chemical agents in several tidal creeks in the Edgewood Area. Available data to characterize the extent of impacts from toxics is quite limited. The majority of data collected by APG environmental staff is limited to conventional constituents and certain metals. According to these data (which are available since 1979), conventional water quality conditions are relatively good.

In general, the environmental management activities at APG have resulted in recent improvements in waste management and elimination of potential sources of pollutants at the Aberdeen and Edgewood Areas. Environmental enhancement activities also include ongoing SAV revegetation, marsh reconstruction, wildlife management programs, and protection of bald eagle nesting areas. Despite these improvements, however, there are several areas of concern which remain, and are addressed by the following recommended actions:

- Review the Aberdeen STP treatment system operation to determine means to upgrade equipment or operating procedures to eliminate problems in meeting State/EPA permit limits for phosphorus, pH, and residual chlorine.

A B E R D E E N   P R O V I N G   G R O U N D

ON-SITE SCREENING CRITERIA (ON-SITE IMPACT POTENTIAL)		
NON-POINT SOURCES	1. Erosion/Sedimentation	+
	2. Impervious Area Runoff	·
	3. Combined Storm Drains	-
	4. Shoreline Erosion	-
POINT SOURCES	5. Sewage Treatment	-
	6. Industrial Waste Treat	+
	7. Remote Sewage Treatmnt	·
HAZARDOUS/TOXIC MATERIALS	8. Refueling Operations	-
	9. Munitions Operations	Θ
	10. Chemical Operations	Θ
	11. Pesticides	+
	12. Vehicle Maintenance	-
	13. Ship Maintenance	·
	14. Solid Waste Disposal	·
	15. Hazardous Waste	-
	16. SPCC Status	+
	17. Abandoned Sites	Θ
	18. LUST Status	-
ENVIRONMENTAL PROGRAMS	19. Forestry Mgmt. Plan	+
	20. Wildlife Mgmt. Plan	⊕
	21. Soil Conservation Plan	+
	22. Stormwater Mgmt. Plan	-
	23. Wetlands Mgmt. Plan	+
	24. Shoreline Erosion Plan	-

VICINITY SCREENING CRITERIA		
RELATIONSHIP TO LOCAL ENVIRONMENT	25. Shellfish Areas	·
	26. SAV Areas	⊕
	27. Fish Spawning Areas	-
	28. Wetlands Areas	-
	29. Waterfowl Nesting	⊕
	30. Endangered Species	⊕
	31. Relative Local Impact	-

STUDY GROUP		
IMPACT POTENTIAL	1. Significant	X
	2. Poorly Defined, Sig.	
	3. Poorly Defined, Insig.	
	4. Insignificant	

KEY:

Impact Category 1: Θ Significant Impact Potential (Adverse)
⊕ Significant Impact Potential (Beneficial)

Impact Category 2: - Unknown or Poorly Defined (Adverse)
+ Unknown or Poorly Defined (Beneficial)

Impact Category 3: · Insignificant Impact Potential (Adverse or Beneficial)

Table 4.4 Installation Screening Matrix of Aberdeen Proving Ground

Table 4.5 Summary of Areas of Concern and Recommendations for APG

ACTIVITY/POLLUTANTS OF CONCERN	ONSITE	OFFSITE/VICINITY	RECOMMENDATIONS	EST. COST
Aberdeen Area STP phosphorus, pH, chlorine	Tertiary STP is in frequent noncompliance with permit limits for phosphorus, pH, and residual chlorine. STP upgrades to correct deficiencies are in planning stages.	APG water quality data show generally good water quality conditions in Spesutie Narrows for conventionals and metals. No sediment quality data available.	Review STP operations and determine and implement upgrades, including change in precipitator chemicals for phosphorus removal, and increase SO_2 application.	Study: $30,000 Upgrades: $60,000 to $150,000
Aberdeen and Edgewood STP's/ possible toxics in effluent	Both STP's accept industrial waste, not all pretreated. A toxics monitoring program is planned for the Aberdeen Area STP. No data are yet available.	No information available on levels of toxics in sediments or benthic biota in vicinity of STP outfalls.	Review effluent toxics monitoring program data to determine industrial pretreatment requirements, if any, for Aberdeen Area STP. Determine need for similar program at Edgewood STP.	Pretreatment study: $50,000 - $100,000
Stormwater runoff from uncontrolled munitions testing/ operations, chemical burning areas, and vehicle test track operations.	Active detonation of chemicals and propellants on at least 3 areas - "J," "O" and "Old Bombing" Fields. Perryman vehicle test track adjacent to sod Run and Romney Creek.	Limited data collected in 1981 shows low levels of munitions chemicals in local receiving waters at active burn sites. Data is statistically inconclusive, however. Study performed in 1984 at Perryman Test Track shows high TSS levels in Sod Run, and low pH. No toxic levels were observed in receiving waters.	Develop a stormwater management plan for APG, including monitoring of munitions chemicals adjacent to active detonation/ burn areas, and test track areas.	Develop SWM plan: $40,000 Monitoring $100,000/yr Feasibility study for controls: $50,000 - $100,000 each site

Table 4.5 Summary of Areas of Concern and Recommendations for APG (continued)

ACTIVITY/POLLUTANTS OF CONCERN	ONSITE	OFFSITE/VICINITY	RECOMMENDATIONS	EST. COST
Wetland and Open Water Test Firing Ranges - metals, ordnance chemicals, shock waves	Large wetlands and open water areas contaminated by millions of UXO's and duds.	Available APG biological species data from 1980 show no statistically significant trends in biota stress.	If possible, confine future firing to limited areas, of low habitat value.	unknown
White Phosphorus (WP) deposit	Large area of WP deposited in tidal flat near entrance to Spesutie Narrows, adjacent to channel dredging activities.	Studies (Sullivan, et al, 1979) show elemental P in water at 1 ug/l extremely toxic to aquatic life.	Conduct monitoring and feasibility study of WP deposit to determine extent of deposit, associated risks, and feasible mitigation measures.	Study: $150,000 Monitoring: $100,000
Inactive disposal sites, landfills, chemical and munition burnpits, and past industrial discharges to creeks	AEHA and APG data in several creeks (Kings, Canal, Watson, Wright) show elevated levels of trace organics and metals above EPA threshold toxicity levels for aquatic life.	Available data confined to creeks on site.	Expand current stream monitoring program to include sediment quality, priority pollutants, ordnance and research chemical agents at selected locations.	Monitoring $200,000/yr Develop program: $40,000
Hazardous waste CERCLA Confirmation Sites/inactive landfills, trace organics, pesticides, metals	Several inactive landfills believed to be leaching toxics into groundwater system, with possible off-post migration and/or to surface waters.	No data available for review at this time. Monitoring programs being planned by APG and USATHAMA.	Recommendations await findings of USATHAMA confirmation studies.	Confirmation study: $500,000 - $1,000,000

Table 4.5 Summary of Areas of Concern and Recommendations for APG (continued)

ACTIVITY/POLLUTANTS OF CONCERN	ONSITE	OFFSITE/VICINITY	RECOMMENDATIONS	EST. COST
Untreated NPDES industrial discharges - oil and grease, ordnance chemicals, phenols, pH	Outfalls are used intermittently. Treatment facilities scheduled for installation at outfalls 003, 004, 010 and 006 by Oct., 1986. Outfall 007 to be disconnected.	APG water quality data show moderately stressed conditions for several streams.	Recommendations dependent on status of actions to be taken to upgrade or disconnect these discharges as planned.	--

- Review status of the proposed effluent toxics monitoring program for the Aberdeen STP, and institute a similar program for the Edgewood Area STP.

- Develop a stormwater management plan which incorporates monitoring of runoff quality (including chemical agents) from industrial areas and munitions test/burn areas.

- Review current ordnance firing/test range operations and procedures to determine feasibility of confining active test ranges to areas of "low" environmental quality.

- Perform a risk assessment and feasibility study to determine need for, and methods for remediation of, the white phosphorus (WP) deposit near Spesutie Narrows.

- Expand APG's surface water quality monitoring program to include periodic monitoring at certain locations for priority pollutants and chemical agents which are more representative of materials discharged from past activities. Sediment quality and limited biological (benthic) sampling is also recommended for a limited number of sampling locations.

- Recommendations concerning CERCLA sites await review of findings from ongoing USATHAMA investigations to confirm contaminant migration from several inactive landfills.

4.3 REGION 2: MOUTH OF SEVERN RIVER (UPPER CENTRAL BAY)

4.3.1 Tributary/Regional Description

4.3.1.1 **Environmental Setting**. The Severn River is a small (ca 8 miles) estuarine tributary on the western shore of the upper central Bay (see Figure 4.3). The Severn River is generally shallow (18-20 ft), except for a 50-foot hole southeast of the Naval Academy at Annapolis, which was dredged for landfill for the Naval Academy grounds. Salinities range from 6 ppt in spring to 12 ppt in fall. The mean tidal range is 0.9 feet at Annapolis.

Typical of most tributaries of the upper Bay, the Severn River is a known fish spawning and nursery area for marine and estuarine anadromous fishes. The headwaters, Severn Run, support a popular spring sport fishery for yellow perch, and one of its major branches is a natural trout stream. The stretch of river by the urban-Naval complex is a migratory route for spawning adults, as well as for emigrating larvae and fry.

Avifauna of the Upper Central Bay is characteristic of the local habitat, i.e., suburban, forested, etc., but the density of development is such that the shy bald eagle no longer nests in the area. Ospreys, however, are still common. In addition, small flocks of waterfowl, primarily diving ducks, use the area during the winter months.

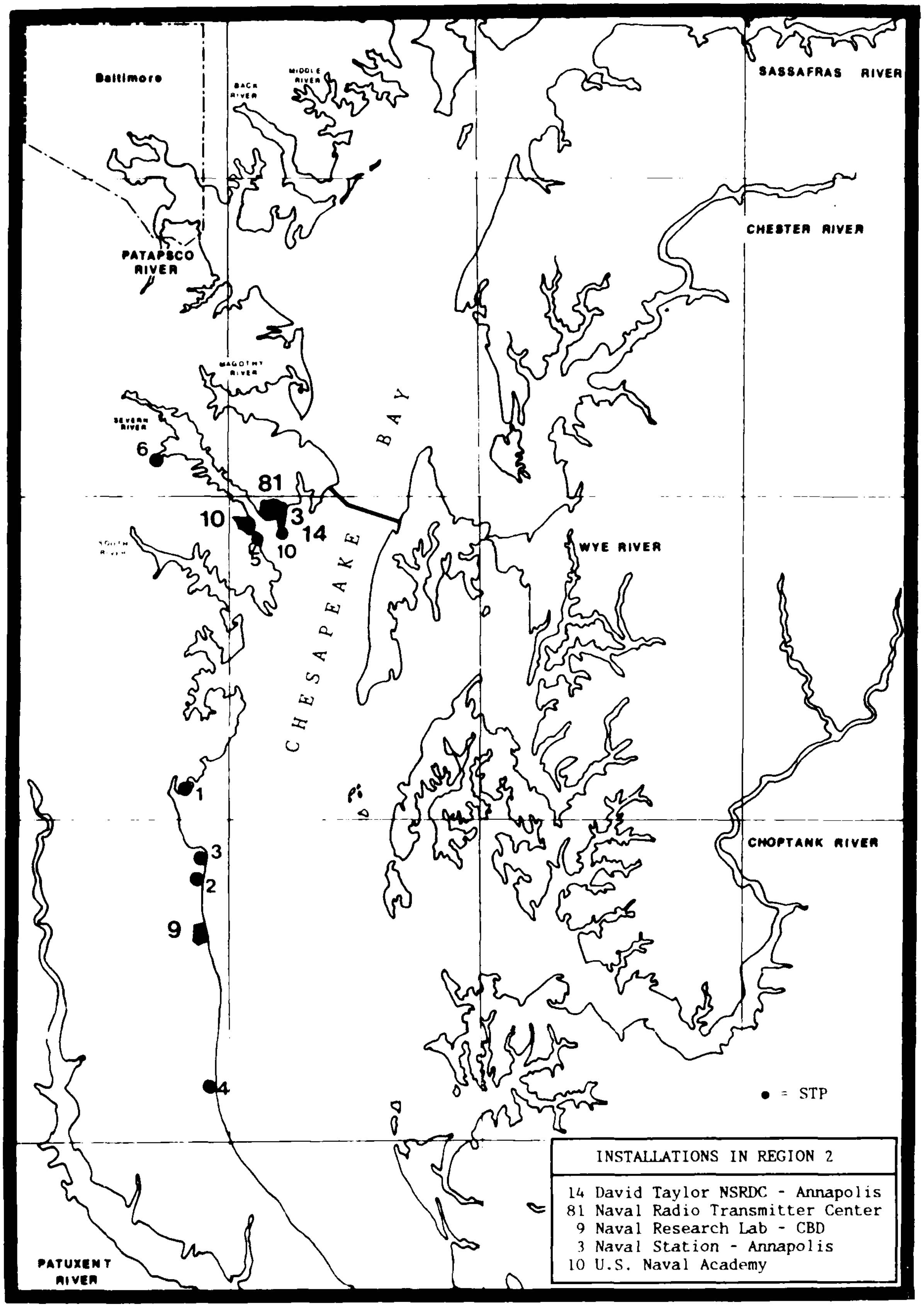


Figure 4.3 Region 2 - Mouth of Severn River (Upper Central Bay)

The Severn River has been named a "Scenic River" by the state, which is a statutory designation. Consequently, environmental trends, including development, are carefully watched by the Severn River Commission.

Water quality conditions in the tributary are periodically impacted by sewage pumping station overflows and construction activities. There is continuing pressure to protect the remaining small bogs and wetlands, primarily from residential development. As a result of poor flushing characteristics in the upper tidal reaches, low dissolved oxygen can occur during the summer, in coves and tributaries, sometimes resulting in fish kills.

Located at the mouth of the Severn, Annapolis is currently a major boating and tourist center. In the warmer months, extensive use is made of these waters by power and sailing craft. Water quality suffers in the area, primarily from urban runoff as well as discharge from boats.

The Severn River at Annapolis has historically been oystering grounds, but the area has been closed to shellfish harvesting by the State Health Department because of coliform contamination.

There are a total of five DoD installations in the Upper Central Bay region. These represent 8% of the total number of installations operating in the Chesapeake Bay drainage basin. Figure 4.4 shows the approximate locations of the DoD installations relative to the Chesapeake Bay.

4.3.1.2 Vicinity Pollutant Loadings.

Vicinity Point Sources. Municipal sewage treatment plants currently discharging to the Severn River, South River, and adjacent central Chesapeake Bay area are listed in Table 4.6 and shown in Figure 4.3. The STPs in the Severn River near the Naval Station have a combined average discharge flow of 6.7 MGD, including the 0.25 MGD flow from the Naval Station, Annapolis. Sanitary wastes from the Naval Academy, on the opposite side of the Severn River, are routed to the City of Annapolis STP, which also discharges into the Severn River. No estimates are available for metals or toxics loads from point sources to the Severn River area, but these are expected to be minor.

Vicinity Nonpoint Sources. Rapid urbanization throughout the Severn River basin is the primary reason for the degraded water quality conditions. Nonpoint sources include urban runoff, pumping station overflows, and recreational boating. There are no quantitative estimates available for nonpoint source pollutant loads in this area.

4.3.1.3 Relative Comparison to DoD Installation Pollutant Loads.

Point Sources. The STP discharge from the Naval Station, Annapolis represents approximately 4% of the conventional pollutant loads to the Severn River from point sources. Data on metals or toxics were not

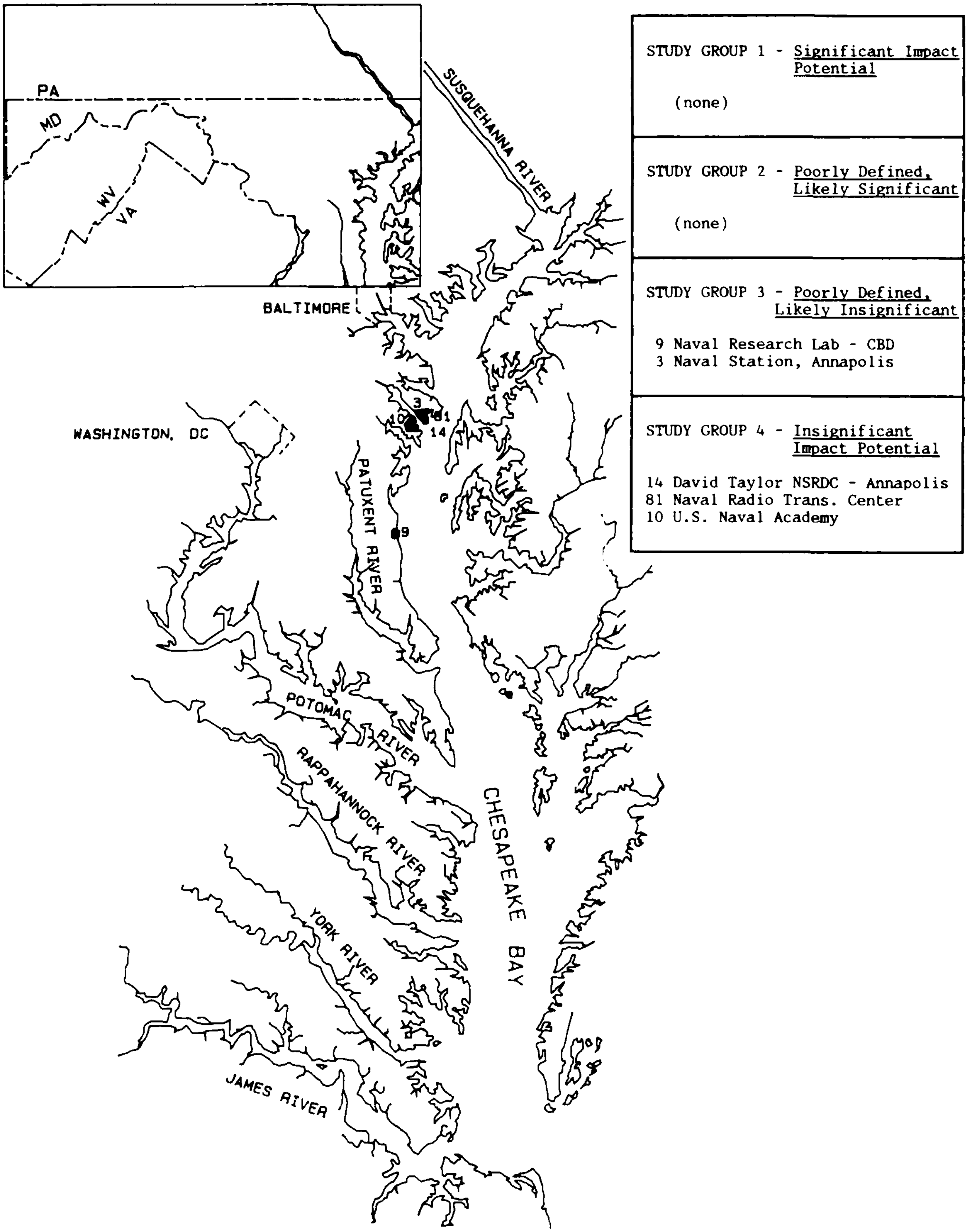


Figure 4.4 Location of DoD Installations in the Upper Central Bay Region and Summary of Installation Impact Potential.

Table 4.6 Comparison of Point Source Conventional Pollutant Loadings (lbs/day) to the Central Chesapeake Bay *

SEVERN RIVER

NO.	NPDES	NAME	BOD5	NH3	TKN	TN	PO4	TP	TSS	(MGD) FLOW
5	21814	ANNAPOLIS STP, CITY OF	367.503	700.144	853.60	959.10	220.334	259.217	378.832	6.2125
6	23663	CROWNSVILLE HOSPITAL	56.329	30.429	37.10	41.68	15.231	18.025	56.329	0.2700
10	23523	NAVAL STATION, ANNAPOLIS	41.8	--	--	--	--	--	20.9	0.2500
			465.63	730.573	890.70	1000.78	235.655	277.242	456.06	6.73

CENTRAL BAY

NO.	NPDES	NAME	BOD5	NH3	TKN	TN	PO4	TP	TSS	(MGD) FLOW
1	24150	BROADWATER STP	100.785	70.099	85.46	96.03	13.236	15.572	104.004	0.6220
2	20281	CHESAPEAKE BCH TOWN OF MAYOR/COUNCIL	39.639	21.413	26.11	29.33	10.782	12.684	39.639	0.1900
3	20478	NORTH BEACH TOWN OF	14.604	7.889	9.62	10.81	3.972	4.673	14.604	0.0700
4	51381	PRINCE FREDERICK WASTE TREAT FAC	22.949	12.397	15.11	16.98	1.170	1.377	22.949	0.1100
			177.976	111.798	136.30	153.15	29.160	34.306	181.195	0.9920

* Based on summer 1984/1985 conditions reported by USEPA (J. Macknis, Personal Communication)

STP No.'s are keyed to the locations shown in Figure 4.3

available for comparison, but are believed to be similarly minor since there are no major industrial facilities on the installations.

Nonpoint Sources. In terms of nonpoint source contributions, the DoD installation activities in the Annapolis - Severn River area are expected to contribute relative loadings according to the size of the land surface area occupied by the installations and the predominating land use thereon. The combined total area of the five DoD installations on the Severn River is approximately 1,000 acres, or about 1.5 square miles. This represents about 3% of the drainage area of the Severn River. With its location directly on the Severn River, coupled with the mixed urban, open land use that exists, the naval installations contribute correspondingly to the nonpoint source pollutant loadings into the Severn. Careful land management and best management practices for control of storm water runoff should be placed as a high priority for these installations.

4.3.1.4 Summary of DoD Impacts on the Upper Central Bay. There are five DoD installations in the Upper Central Bay Region (see Figure 4.4). Of these five installations, two installations (Naval Radio Transmitter Center and Naval Research Lab, Chesapeake Bay Detachment) were estimated during Phase I of this study to represent a likely insignificant potential for water quality impacts. The remaining three - Naval Station Annapolis, US Naval Academy, and DTNSRDC Annapolis - were estimated to represent a poorly defined but likely significant potential for adverse water quality impacts by virtue of their locations and activities, and were examined in greater detail during Phase III of this study.

Table 4.7 presents the results of the final screening of all five DoD installations in this region. Based on a more detailed review and assessment of conditions at these installations, none of the installations were found to represent a likely significant potential for adverse water quality impacts. There are no major industrial activities or point sources existing at these facilities. Existing areas of concern are relatively minor in nature and include: release of pollutants in storm drains (DTNSRDC, U.S. Naval Academy); shoreline erosion at the Naval Station and NRL-CBD; and questionable management of hazardous materials (Naval Station, U.S. Naval Academy). No information exists, however, to indicate that these installations have created any significant adverse impacts on water quality. Compared to the surrounding point and nonpoint sources, these installations probably contribute an insignificant loading of pollutants to the Upper Central Bay region. Beneficial activities on these installations have included upgrading sewage treatment systems (Naval Station, NRL-CBD), and development of land management and natural resources programs (all installations). The following sections summarize findings and recommendations for each installation in this region.

4.3.2 Installation 3: Naval Station, Annapolis

4.3.2.1 General. The Naval Station, Annapolis is the major support installation for Naval Operations in the Annapolis area, including the U.S.

Table 4.7 Summary of Final Screening for Installations in the Upper Central Bay Region

ON-SITE SCREENING CRITERIA (ON-SITE IMPACT POTENTIAL)

ID	Branch	Installation Name	NON-POINT SOURCES: 1. Erosion/Sedimentation	2. Impervious Area Runoff	3. Combined Storm Drains	4. Shoreline Erosion	POINT SOURCES: 5. Sewage Treatment	6. Industrial Waste Treat	7. Intermitt Sewage Treat	HAZARDOUS/TOXIC MATERIALS: 8. Refueling Operations	9. Munitions Operations	10. Chemical Operations	11. Pesticides	12. Vehicle Maintenance	13. Ship Maintenance	14. Solid Waste Disposal	15. Hazardous Waste	16. SPCC Status	17. Abandoned Sites	18. LUST Status	ENVIRONMENTAL PROGRAMS: 19. Forestry Mgmt. Plan	20. Wildlife Mgmt. Plan	21. Soil Conservation Plan	22. Stormwater Mgmt. Plan	23. Wetlands Mgmt. Plan	24. Shoreline Erosion Plan
3	NAVY	Naval Station-Annap.	+	·	·	+	+	·	·	·	·	·	·	·	-	·	·	·	·	·	+	⊕	+	·	+	-
10	NAVY	U.S. Naval Academy	·	-	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	+	+	-	+	·
14	NAVY	David Taylor-Annap.	+	-	-	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·
81	NAVY	Naval Radio Trn. Fac.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·
9	NAVY	Naval Res Lab-CB Det.	·	·	·	-	⊕	·	·	·	·	·	·	·	·	·	·	+	-	·	+	+	+	+	+	+

VICINITY SCREENING CRITERIA / STUDY GROUP

ID	Branch	Installation Name	RELATIONSHIP TO LOCAL ENVIRONMENT: 25. Shellfish Areas	26. SAV Areas	27. Fish Spawning Areas	28. Wetlands Areas	29. Waterfowl Nesting	30. Endangered Species	31. Relative Local Impact	IMPACT POTENTIAL: 1. Significant	2. Poorly Defined, Sig.	3. Poorly Defined, Insig.	4. Insignificant
3	NAVY	Naval Station-Annap.	-	·	-	+	·	·	+			X	
10	NAVY	U.S. Naval Academy	-	·	-	-	·	·	·				X
14	NAVY	David Taylor-Annap.	-	·	-	·	·	·	+			X	
81	NAVY	Naval Radio Trn. Fac.	-	·	-	+	·	·	+				X
9	NAVY	Naval Res Lab-CB Det.	+	·	·	·	·	·	+			X	
		Total Number of Installations per Study Group								0	0	3	2

Score Totals

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
·	3	3	3	3	3	5	5	5	5	5	5	5	4	5	5	3	4	5	2	2	2	3	1	3
+	2	0	1	1	1	0	0	0	0	0	0	0	0	0	0	2	0	0	3	2	3	1	4	1
⊕	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
-	0	2	1	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0	1
⊖	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	25	26	27	28	29	30	31
·	0	5	1	2	5	5	1
+	0	0	0	2	0	0	4
⊕	0	0	0	0	0	0	0
-	4	0	4	1	0	0	0
⊖	0	0	0	0	0	0	0

KEY: Impact Category 1: { ⊖ Significant Impact Potential (Adverse)
⊕ Significant Impact Potential (Beneficial)

Impact Category 2: { - Unknown or Poorly Defined Impacts (Adverse)
\+ Unknown or Poorly Defined Impacts (Beneficial)

Impact Category 3: · Insignificant Impact Potential (Adverse or Beneficial)

Naval Academy (USNA), Naval Radio Transmitter Center (NRTC), and David Taylor Naval Ship Research and Development Center (DTNSRDC).

The Naval Station, Annapolis is located across the Severn River from downtown Annapolis and the U.S. Naval Academy (see Figure 4.3). The station is located 32 miles east of Washington, D.C. and 26 miles south of Baltimore, MD. The station occupies an area of 275 acres and is bordered on the south and west by DTNSRDC and the Severn River, on the east by Carr's Creek, on the north by the U.S. Naval Academy's North Severn recreational facility, and on the northwest by private property.

4.3.2.2 **Summary of Impact Potential and Recommended Actions**. In Phase I of this study, Naval Station, Annapolis was screened in Study Group 2 based on: the presence of an abandoned landfill; boatyard maintenance and repair operations along the Severn River; and, presence of the 0.25 MGD STP discharging into Carr Creek. The installation assessment methodology was applied to Naval Station, Annapolis during Phase III to better define the likely character and extent of its impact on local receiving waters. As a result of this assessment, the Naval Station, Annapolis has been reassigned to Study Group 3 (poorly defined, likely insignificant) because: no contaminant migration has been detected from the abandoned landfill; maintenance and repair operations at the boatyard are being upgraded; and, the STP has been found to be in general compliance with State NPDES limits. In general, the magnitude and likelihood of events which could impact water quality is small in comparison to other area-wide activities (i.e., urban runoff, sewage discharges, boat discharges). Table 4.8 summarizes the areas of concern and recommended actions identified for Naval Station, Annapolis.

Recommended actions for Naval Station, Annapolis include:

- Correct shoreline and bluff erosion using best management practices;
- Investigate potential POL (petroleum and other liquids) spill sites and take remedial action as necessary;
- Disconnect two septic systems and discharge directly into sanitary sewer collection system; and
- Provide emergency generators for pump stations that pump sewage to the base STP.

4.3.3 Installation 10: United States Naval Academy

4.3.3.1 **General**. The U.S. Naval Academy (USNA) is located in Annapolis, Maryland at the junction of the Severn River and Spa Creek. The southern (main) portion of the installation is bisected by College Creek. This area covers a total of 338 acres including 17 acres for the Naval Hospital. Another 296 acre portion of the installation north of the Severn River is used for recreation. The primary mission of the USNA is to train officers

Table 4.8 Summary of Areas of Concern and Recommendations for Naval Station, Annapolis

ACTIVITY/POLLUTANTS OF CONCERN	ONSITE	OFFSITE/VICINITY	RECOMMENDATIONS	ESTIMATED COST
Advanced Wastewater Treatment Plant Outfall and Occasional Overflow/ BOD, TSS, Toxics		Garrison (1986) reports that nutrient and bacterial levels elevated resulting in shellfish harvesting closures, algal blooms and fish kills.	Provide emergency generator power to all pump stations especially Building 106.	Pump Station upgrades: $30,000
Overhaul & Maintenance of Training and Tender Fleet/ oil & grease, metals, volatile organics.	Oil & grease trap effluent goes to STP for treatment.	Nonpoint emissions from these activities have not been documented.	Implement changes outlined in Master Plan (CHESDIV, 1983) to improve maintenance and repair facilities.	Upgrade o/w separators and new nonpoint source controls: $50,000
Fire Station Fuel Tank, Service Station Used Oil Tank/	Area surrounding tanks is devoid of vegetation due to spills and/or leaks.	Potential for groundwater contamination and eventual offsite migration.	Investigate source/extent of spills and test tanks for leaking. Remedial measures as appropriate.	Test: $5,000 Cleanup: $30,000-$50,000
Shoreline Erosion	Three locations experience bluff/shoreline erosion. At one site, erosion threatens road and recreational park.	Bluff erosion affects water quality of fresh water pond, whereas shoreline erosion causes turbidity in Severn River.	Implement bluff & shoreline erosion control measures outlined in CHESDIV, 1985.	$200/ft of shoreline

for the U.S. Navy and Marine Corps. Currently, there are about 4500 officercandidates being trained at this fully equipped university.

4.3.3.2 **Summary of Impact Potential and Recommended Actions**. In Phase I of this study, USNA was screened in Study Group 2 based on: the potential for fuel tank leaks; chemical waste handling; and, NPDES limit violations from point source discharges. During Phase III, the installation assessment methodology was applied to USNA to better define the likely character and extent of its impact on local receiving waters. As a result of this assessment, USNA has been reassigned to Study Group 4 (likely insignificant) because: the fuel tanks in question have adequate secondary containment per existing EPA criteria; the disposition of chemical wastes is now governed by a new hazardous material/hazardous waste policy; and, efforts are underway to connect the outfall to the sanitary sewer system rather than overboard discharge. Although the receiving waters of this facility are degraded by rapid urbanization and naturally poor flushing characteristics, USNA does not contribute significantly to water quality problems in Chesapeake Bay. Table 4.9 summarizes the areas of concern and recommended actions identified for USNA.

Recommended actions for USNA include:

- Complete the connection of discharge 004 to the sanitary sewer system; and,
- Implement USNA/ACC Instruction 5090.1 (Feb 1987) to control handling of hazardous materials/hazardous waste generated on site.

4.3.4 Installation 14: David Taylor Naval Ship Research and Development Center

4.3.4.1 **General**. The primary mission of the David Taylor Naval Ship Research and Development Center (DTNSRDC) is the design and testing of shipboard systems and materials. The base occupies a 90 acre parcel bordered on the south by the Severn River and completely surrounded on the landward side by the Naval Station, Annapolis. The base employs approximately 800 people including both military and civilian in various research and development activities. Sanitary sewers are connected to the Naval Station STP.

4.3.4.2 **Summary of Impact Potential and Recommended Actions**. In Phase I of this Study DTNSRDC was screened in Study Group 2, based on: the installation's proximity to the Severn River; the potential for stormwater runoff of pollutants from a large impervious surface area and steep slopes; and poorly characterized discharges from building drains and sumps. As a result of the more detailed assessment during Phase III of this study, however, DTNSRDC has been reassigned to Study Group 3 (poorly defined but likely insignificant impact potential). Table 4.10 summarizes the areas of concern and recommended actions identified for DTNSRDC. As shown in this table, areas of concern include inadequate monitoring of several storm drains and minor industrial discharges, and lack of a stormwater management

Table 4.9 Summary of Areas of Concern and Recommendations for U.S. Naval Academy

ACTIVITY/POLLUTANTS OF CONCERN	ONSITE	OFFSITE/VICINITY	RECOMMENDATIONS	ESTIMATED COST
NPDES Discharge 004 Mess Hall Trash Compactor Drain/ DO & coliform.		DO & coliform limits have been exceeded in past contributing to stressed environment of Severn River.	Convert discharge from trash compactor drain area to sanitary sewer system leaving only surface runoff as discharge 004.	<u>Connection to main sewer</u>: $80,000
Hazardous Waste Generated at Science and Engineering Laboratories/ chemicals.	Handling, control, labeling, storage and transport and disposal policies need review/ enforcement.		Implement USNA/AAC Instruction 5090.1 Feb 1987 to control handling of hazardous materials/waste generation.	<u>Start up</u>: $20,000 <u>Tracking</u>: $10,000/year

plan to ensure use of BMP's for nonpoint source controls. Recommended actions for DTNSRDC include:

- Conduct periodic wet weather monitoring of storm sewer outfalls to characterize effluents and determine need for sediment or oil/water separators, or connection to the sanitary sewer system.

- Review the monitoring procedures for the NPDES discharges and correct deficiencies.

4.3.5 Installation 81: Naval Radio Transmitter Facility, Annapolis

4.3.5.1 **General**. The Naval Radio Transmitter Facility (NRTF) is located on a 285 acre peninsula and has more than 3 miles of waterfront bordering Carr Creek, the Severn River, and the Chesapeake Bay. The primary mission of the NRTF is fleet communications. The site is composed of several buildings, some of which are unused, a small dock, and a small housing complex for married military personnel. There are no industrial activities at the facility. Solvents used in radio repair are collected and removed from the installation by DLA. The sanitary sewer is connected to the Naval Station STP. The installation is designated as a migratory bird sanctuary and has many different species wintering on the shores and in the nearby marshes.

4.3.5.2 **Summary of Impact Potential and Recommended Actions**. The screening data for NRTF are summarized in Tetra Tech (1986). The installation has very little potential to impact the water quality in the Severn River and has the effect of a buffer to potential development in an area of high development pressure. The Naval Radio Transmitter Facility, Annapolis has been placed in Study Group 4 (insignificant impact) for the Phase III screening, as shown in Table 4.7. This installation did not receive additional analysis during Phase III of this study. There are no recommended actions for NRTF.

4.3.6 Installation 9: Naval Research Laboratory Chesapeake Bay Detachment (CBD)

4.3.6.1 **General**. The Naval Research Laboratory CBD is located in Calvert County, Maryland approximately 40 miles east of Washington, D.C. The site covers 170 acres in the rural Randle Cliff area on the Chesapeake Bay. CBD is situated behind a bluff area on the open Bay, and is subject to high energy wind and wave action, making it vulnerable to a rapid rate of erosion. CBD is a major field test center of the Naval Research Laboratory (NRL). Its primary mission is to provide and maintain facilities for use by the research divisions of NRL for testing, developing, and evaluating radar research projects requiring a maritime environment or open skies.

4.3.6.2 **Summary of Impact Potential and Recommended Actions**. The screening data for CBD are summarized in Tetra Tech (1986). Based on the screening criteria, CBD has been placed in Study Group 3, having a poorly defined but likely insignificant impact potential on ecological resources of

Table 4.10 Summary of Areas of Concern and Recommendations for DTNSRDC, Annapolis

ACTIVITY/POLLUTANTS OF CONCERN	ONSITE	OFFSITE/VICINITY	RECOMMENDATIONS	ESTIMATED COST
Storm Drains / Oil and grease, TSS, pH	Several storm drains, some with combined minor industrial discharges, are largely unmonitored during wet weather events.	Severn River exhibits stressed conditions due to urbanized nature of surrounding area.	Develop stormwater management plan to include periodic wet weather monitoring to determine possible need for controls.	Develop Plan: $20,000 Monitoring: $20,000/year
NPDES Permit for Minor Industrial Discharges / Oil and grease, TSS, pH	Up to 30 separate industrial and building discharges on base. NPDES required monitoring is insufficient to characterize effluents.	Same as above.	Correct deficiencies in NPDES monitoring activities.	Additional Monitoring: $15,000/year

Chesapeake Bay (see Table 4.7). Major considerations for this judgement include the following:

a. CBD, due to its highly erodible soils and steep slopes, has an erosion problem both inland and along the Chesapeake Bay. Present programs are not effective in controlling the erosion problem, especially during periods of heavy storm activity.

b. Domestic wastewater treatment is provided by a secondary sewage treatment plant and includes the use of ultraviolet light to reduce coliform counts. There are no industrial activities discharging into the sanitary sewer system.

c. There were nine non-confirmation (not warranted for additional testing) sites identified at CBD. These sites are a result of past activities including landfill disposal, an oil spill, road oil application, mercury well water contamination, and photoprocessing waste discharge. Although the sites did not warrant confirmation studies, a monitoring program has been established to test for leachate migration.

d. CBD has an active natural resources program including forestry, wetlands, and wildlife management. Oyster spawning and harvesting areas and blue crab overwintering grounds are located in the vicinity of CBD. The oyster harvesting season, however, has been closed in the past because of high bacteria counts due to municipal discharges. The bald eagle is known to nest in an area adjacent to CBD. A migratory and overwintering area of the diving duck is also located along the shoreline. There has been no report of SAV's in this area in the last ten years.

CBD has limited potential to impact the ecological resources of the Chesapeake Bay. There is little industrial and hazardous waste generated on-site and there is adequate domestic wastewater treatment. This installation did not receive additional analysis during Phase III of this study. Recommended actions for CBD relate to the need for control of overland (runoff induced) erosion as well as shoreline erosion. These recommendations are summarized in Chapter 5 of this report.

4.4 REGION 3: MOUTH OF PATUXENT RIVER (CENTRAL BAY)

4.4.1 Tributary/Regional Description

4.4.1.1 Environmental Setting. The Patuxent River drains the smallest basin within the Bay catchment area, flowing 110 miles to its confluence with the Chesapeake Bay at Solomons Island (see Figure 4.5). The lower two-thirds of the river drains the Atlantic Coastal Plain Province. The average depth of the lower Patuxent River is 15 feet. The mean tidal range is 1.2 feet at Solomons Island.

The waters are mesohaline, generally ranging from 10 to 18 ppt. This is nearly an optimal environment for many traditional estuarine species, and harvesting of finfish and shellfish has historically been a local mainstay of the economy. Among the commercial and sport fish are striped bass, white perch, spot, weakfish, and bluefish. Oysters, soft shell clams, and blue crab are important shellfish harvests. Pound net fisheries are found in the area, which also harvest the anadromous herring and menhaden.

Many migrating waterfowl overwinter in the area, especially in cold winters when the fresh waters of the upper Bay freeze. There are no known bald eagle nests in the area.

The water quality in the Patuxent River area is impacted by nutrient concentrations that are among the highest in the Bay tributaries. Therefore, it is not unusual to see oxygen depleted conditions in the deep waters of the lower estuary. The Chesapeake Bay Program has attributed reduced abundances of finfish and shellfish in the Patuxent to high nutrient loadings. Submerged aquatic vegetation decline may also be attributed to the high level of nutrients. Temporal analysis has indicated an increase in metals in this area. The upper watershed has developed rapidly in the last two decades, putting increasing demands on the river.

The Naval Air Station complex at the mouth of the Patuxent River occupies a peninsula, with waterfront on the river as well as the Bay (see Figure 4.5). Three creeks or ponds are on the installation, as are two dredged inland harbor areas. The region is generally wooded, and the rapidly urbanizing support community, Lexington Park, is developing on the inland side of the facility. There is a closure area for shellfish harvesting on the Bay side of the installation, extending one mile north and south of Pine Hill Run, and 200 yards offshore.

4.4.1.2 Vicinity Pollutant Loadings.

Vicinity Point Sources. There are two known municipal sewage treatment plants discharging in the vicinity of the mouth of the Patuxent River. They include the St. Marys County STP, which treats sanitary sewage from the Naval Air Station/Naval Air Test Center (NAS/NATC), and the newly constructed Calvert County STP, which receives sanitary sewage from NAS Solomons Annex. The approximate locations of these discharges are shown in Figure 4.5. No data from these STPs were available at the time of this study.

Vicinity Nonpoint Sources. Although small by comparison to other major Bay tributaries, the Patuxent River is the largest local source of nonpoint source pollutants to the vicinity of the Naval installations. Estimates of the average nutrient load from point sources above the Fall Line are 4700 lbs/day nitrogen and 2040 lbs/day phosphorus, and from nonpoint sources approximately 4470 lbs/day nitrogen and 1290 lbs/day phosphorus (Maryland DNR, 1982). There are no estimates available for metals or toxics loading to this area from nonpoint sources. A nonpoint source pollution monitoring program is currently underway in the Patuxent River and estuary by the USGS

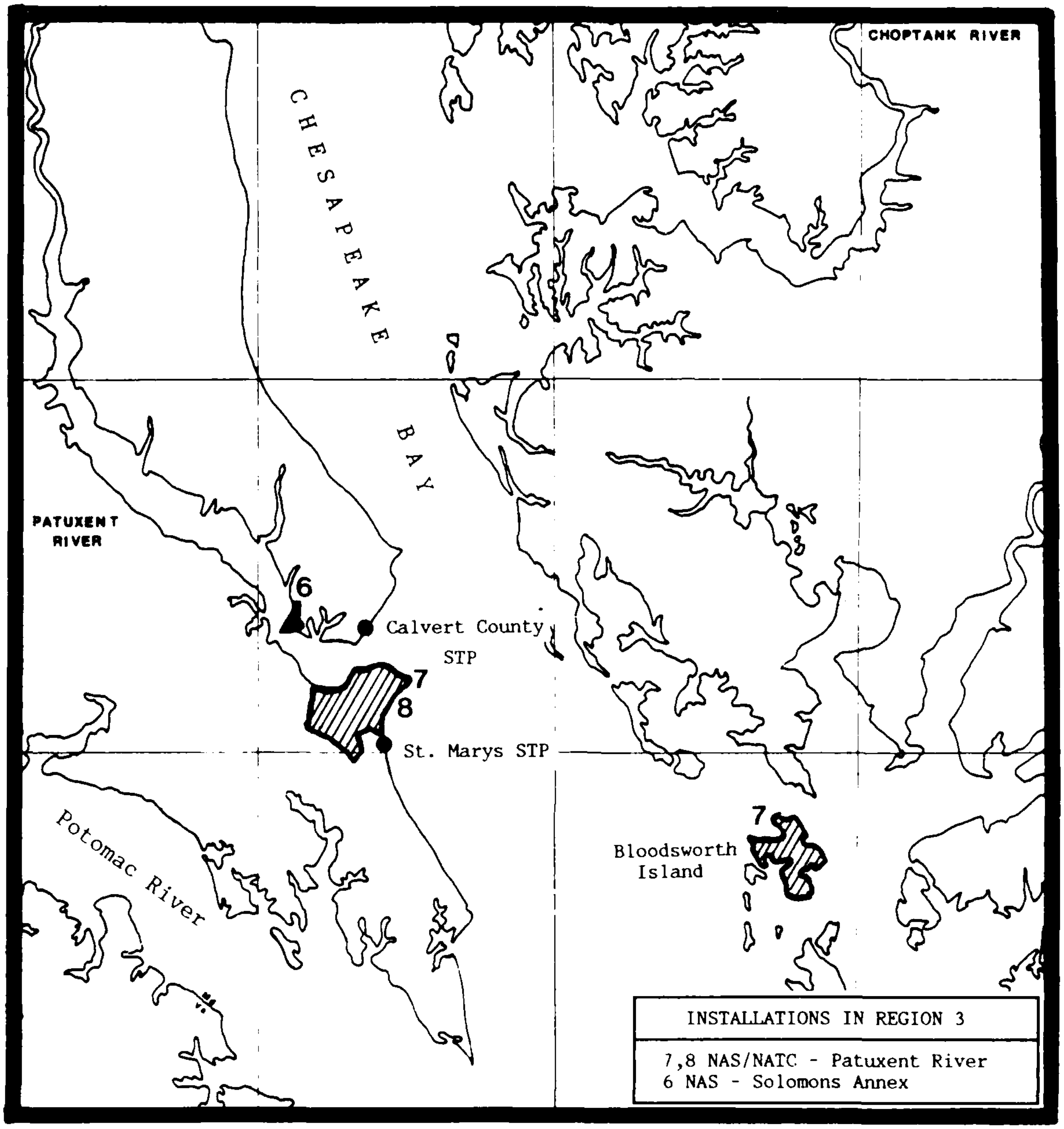


Figure 4.5 Region 3 - Mouth of Patuxent River (Central Bay)

and Maryland OEP. Data collected will be combined with urban and forest runoff estimates and known point source loadings to create a watershed model to help manage Patuxent River water quality.

4.4.1.3 Relative Comparison to DoD Installation Pollutant Loads.

Point Sources. As discussed previously, the sanitary sewage from NAS/NATC Patuxent and from NAS Solomons Annex are treated by the county regional sewage systems. Other point sources from DoD installations include nine industrial wastewater outfalls at NAS/NATC Patuxent which operate under Maryland NPDES Permit MD0020150. Most of these discharges consist of stormwater runoff, runway drainage, fuel storage area runoff, and aircraft service runoff. It was not possible to estimate pollutant loadings from these discharges.

Nonpoint Sources. From recent water quality studies of the Patuxent River (OEP, 1986; Maryland DNR, 1982; Hydroqual, 1981) it has been estimated that runoff of nutrients from agricultural activities, which are extensive in this region, is responsible to a large degree for the stressed (eutrophic) conditions in the lower estuary. Little information is available in this area, however, on contamination by metals or toxics from nonpoint sources. Historical trend data on metals from the EPA Chesapeake Bay Program have indicated an increase in metals concentrations in this area.

The DoD installations in this region are not likely to contribute significantly to the conventional pollutant loadings (BOD, nutrients, sediments). Estimates made in this study for average pollutant loadings from NAS/NATC Patuxent included 70 lbs/day nitrogen, 9 lbs/day phosphorus, and 1260 lbs/day TSS. The extensive storm sewer system and large impervious areas at NAS/NATC Patuxent are undoubtedly a significant local contributor of urban runoff and industrial pollutants (oil and fuel residues, metals, salts, sediments). Very little data are available, however, to characterize the relative pollutant loading amounts originating from NAS/NATC, in comparison to the surrounding sources. It is believed that stormwater management should be a high priority activity in the environmental management of this DoD installation.

4.4.1.4 Summary of DoD Impacts on the Central Bay. NAS Solomons Annex and NAS/NATC Patuxent are the only two DoD installations operating in the Central Bay region (mouth of Patuxent River). NAS Solomons Annex was estimated during Phase I of this study to represent a likely insignificant potential for water quality impacts (Study Group 3). NAS/NATC Patuxent was estimated to represent a poorly defined but likely significant impact potential (Study Group 2) by virtue of its size, location, and the type of activities, and was examined in greater detail during Phase III of this study.

Table 4.11 presents the results of the final screening of the two DoD installations in this region. Based on the Phase III analysis, NAS/NATC was reassigned to Study Group 1, estimated to represent a likely significant

potential for adverse impacts on water quality in the immediate vicinity of the installation. Areas of concern at NAS/NATC include lack of a stormwater management plan and monitoring program for the extensive storm drainage system, lack of secondary containment facilities around POL storage areas, detection of contaminants (fuels) leaking into local onsite surface waters from fuel storage areas, and the continuing evaluation of seven NACIP confirmation study sites including past spill sites and inactive waste disposal sites which have the potential to leach contaminants into ground and surface waters. All of the above concerns relate primarily to activities that are difficult to control or regulate. In general, NAS/NATC's impacts on the regional water quality are believed to be minor. The surrounding agricultural activities and upstream pollutant loadings are primarily responsible for the eutrophic conditions observed in this area. NAS/NATC's impacts are more likely confined to receiving waters located adjacent to the installation. There is a general lack of appropriate data local to the installation, however, to quantify NAS/NATC's impact. The following sections summarize findings and recommendations for the two installations in this region.

4.4.2 Installation 7: Naval Air Station Patuxent River (NAS) Installation 8: Naval Air Test Center (NATC)

4.4.2.1 General. NAS/NATC is located at the mouth of the Patuxent River in St. Marys County, Maryland, about 65 miles southeast of Washington, D.C. The station encompasses about 6400 acres on Cedar Point with much of the land being forested or wetlands. The primary mission of NATC, the senior command, is testing and evaluation of Naval Aircraft Weapons Systems and their components. The primary mission of NAS, the subordinate command, is maintenance and operations of facilities and other services in support of NATC.

4.4.2.2 Summary of Impact Potential and Recommended Actions. NAS/NATC was screened in Study Group 2 in Phase I of this study based on the potential for shoreline erosion, stormwater runoff from the aircraft runway areas, potential of jet fuel spills, and the large number (14) of warranted NACIP confirmation sites on base. The installation assessment methodology was applied to NAS/NATC during Phase III to better define the likely character and extent of NAS/NATC's impact on local receiving waters. As a result of this analysis, NAS/NATC has been reassigned to Study Group 1 partially because it has been determined, based on preliminary information, that leachate from an abandoned waste site is reaching surface waters on base. The installation is situated adjacent to sensitive shellfish harvesting areas and spawning areas for shad, white and yellow perch, and striped bass. Table 4.12 summarizes the areas of concern and recommended actions identified for NAS/NATC. As shown in this table, areas of concern include shoreline erosion; stormwater runoff of heavy metals and fuels; runoff from agricultural outleases; contamination from abandoned waste sites; and lack of a comprehensive surface water quality monitoring program. Insufficient data exist in the vicinity of NAS/NATC to determine its effects on water quality in the Patuxent River and Chesapeake Bay. NAS/NATC has a very commendable natural resources program which promotes waterfowl nesting areas

Table 4.11 Final Screening
Central Bay Region
(Mouth of Patuxent)

ID	Branch	Installation Name	1. Erosion/Sedimentation	2. Impervious Area Runoff	3. Combined Storm Drains	4. Shoreline Erosion	5. Sewage Treatment	6. Industrial Waste Treat	7. Intermitt Sewage Treat	8. Refueling Operations	9. Munitions Operations	10. Chemical Operations	11. Pesticides	12. Vehicle Maintenance	13. Ship Maintenance	14. Solid Waste Disposal	15. Hazardous Waste	16. SPCC Status	17. Abandoned Sites	18. LUST Status	19. Forestry Mgmt. Plan	20. Wildlife Mgmt. Plan	21. Soil Conservation Plan	22. Stormwater Mgmt. Plan	23. Wetlands Mgmt. Plan	24. Shoreline Erosion Plan	25. Shellfish Areas	26. SAV Areas	27. Fish Spawning Areas	28. Wetlands Areas	29. Waterfowl Nesting	30. Endangered Species	31. Relative Local Impact	1. Significant	2. Poorly Defined, Sig.	3. Poorly Defined, Insig.	4. Insignificant
			ON-SITE SCREENING CRITERIA (ON-SITE IMPACT POTENTIAL): NON-POINT SOURCES				POINT SOURCES			HAZARDOUS/TOXIC MATERIALS											ENVIRONMENTAL PROGRAMS						VICINITY SCREENING CRITERIA: RELATIONSHIP TO LOCAL ENVIRONMENT							STUDY GROUP: IMPACT POTENTIAL			
6	NAVY	Naval Air Sta-Sol Anx	+	·	·	+	·	·	·	·	·	·	·	·	+	·	·	+	·	·	+	+	+	+	+	+	-	-	-	-	-	-	·			X	
7	NAVY	Naval Air Sta-Pax Riv	-	-	·	-	·	-	·	Θ	-	·	+	-	·	-	-	-	Θ	-	+	⊕	+	-	+	+	-	-	-	-	+	+	Θ	X			
		Total Number of Installations per Study Group																																1	0	1	0
Score Totals		·	0	1	2	0	2	1	2	1	1	2	1	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1				
		+	1	0	1	1	1	0	0	0	0	0	1	0	1	0	0	1	0	0	2	1	1	1	2	2	0	0	0	0	1	1	0				
		⊕	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0				
		-	0	1	0	1	0	1	0	0	1	0	0	1	0	1	1	1	0	1	0	0	0	1	0	0	2	2	2	2	1	1	0				
		Θ	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1				

KEY: Impact Category 1: { Θ Significant Impact Potential (Adverse)
⊕ Significant Impact Potential (Beneficial)

Impact Category 2: { - Unknown or Poorly Defined Impacts (Adverse)
\+ Unknown or Poorly Defined Impacts (Beneficial)

Impact Category 3: · Insignificant Impact Potential (Adverse or Beneficial)

and presents educational programs for the public. Recommended actions for NAS/NATC include:

- Control shoreline erosion using riprap and/or vegetative methods. Control soil erosion at several former landfill areas by revegetation.

- Establish a stormwater management program to control stormwater runoff from runways. Investigate agricultural runoff from out-leases to determine quantity and quality of runoff.

- Eliminate the source of contamination at NACIP Site 7 in order to prevent leachate from reaching surface waters. Results of the other ten NACIP Phase II sites are yet to be reviewed.

- Since recreational fishing is commonplace on the base, a surface water monitoring program is recommended which would include fish and shellfish tissue bioassays.

4.4.3 Installation 6: Naval Air Station (NAS) - Solomons Annex

4.4.3.1 General. Solomons Annex occupies 295 acres on the Patuxent River in Calvert County, Maryland, approximately 60 miles southeast of Washington, D.C. The primary mission of the annex includes managing the operations of the Naval Recreation Center, an enlisted housing development, and storage and testing facilities for NAS.

4.4.3.2 Summary of Impact Potential and Recommended Actions. The screening data for Solomons Annex is presented in Tetra Tech (1986). Based on the screening criteria, the installation has been screened in Study Group 3, having a poorly defined but likely insignificant impact potential on ecological resources of the Chesapeake Bay (see Table 4.11). The major considerations for this judgement include:

a. The Annex has a problem with bluff erosion along the shoreline which is receding at a rate of 2-4 feet per year. A shoreline erosion control plan was prepared in 1983 but has not been fully implemented. Also, drainage ditches have silted in altering the drainage patterns on the installation. The total area of impacts is small, however. Riprap structures, reshaping of bluffs, and modification of vegetative cover are among the proposed erosion controls.

b. Solomons Annex has limited natural resources. The main use of the installation is recreational and consists of camping areas, ball fields, a boat dock, picnic facilities, a fishing pier, a swimming pool, and other recreational facilities.

c. Blue crab and oysters are harvested in the vicinity of the Annex, although shellfishing has occasionally been prohibited due to

Table 4.12 Summary of Areas of Concern and Recommendations for NAS/NATC Patuxent River.

ACTIVITY/POLLUTANTS OF CONCERN	ONSITE	OFFSITE/VICINITY	RECOMMENDATIONS	ESTIMATED COST
Shoreline Erosion / sedimentation, soil erosion	Shoreline erosion areas exist on the base along the Patuxent River and Chesapeake Bay. Soil erosion also evident at several former landfill areas.	State of Md. Chesapeake Bay Initiatives stresses control of shoreline erosion as a means of limiting sedimentation which degrades SAV growth. SAV in the NAS & NATC vicinity accounts for 9% of total for lower Patuxent River.	Soil/shoreline erosion must be addressed per guidelines in NAS grounds management plan and COE report. Riprap made of concrete runway scrap can be used to control critical shoreline erosion. Noncritical shoreline areas may be protected by vegetative measures.	Update Plan: $30,000 Shoreline erosion control: $400/ft (critical) $125/ft (noncrit.) Control Landfill Erosion: $40,000/landfill
Stormwater Runoff / heavy metal, fuels, oils, agricultural runoff	Runways present large impervious surfaces from which heavy metals, fuel and oil residue washoff into local receiving waters. No-till farming with buffer zones and cover crops minimizes runoff of nutrients.	NAS/NATC is located near sensitive shellfish harvesting areas. Waters of lower Patuxent suffer from algal blooms and low DO due to elevated nutrient levels from agricultural and urban runoff.	Establish stormwater management program and install appropriate controls, e.g., oil/water separators, dry ponds, wet ponds, vegetated drainage ways, etc. to intercept runoff contaminants.	Controls: $200,000
Abandoned Waste Sites / surface water contamination due to leachate	Leachate has been confirmed reaching surface water on base from NACIP Site 7. No data available on 10 other NACIP sites. Base surface waters used for fishing.	Patuxent is an historic spawning area for shad, white and yellow perch, and striped bass. Waters of Patuxent and Chesapeake Bay used for recreational fishing & water contact sports.	Source of contamination at NACIP Site 7 must be eliminated and leachate prevented from reaching surface water. NACIP Phase II recommendations should be implemented.	Leachate Control Feasibility Study: $75,000 Implement NACIP Recommendations: cost unknown
Surface water monitoring program	Ponds on base are used for fishing and off-base waters used for water contact sports.	NAS/NATC is located near sensitive shellfish areas. Water quality problems in lower Patuxent include low DO and algal blooms.	Establish surface water quality monitoring program on base. This could become a part of the base natural resources program	Monitoring: $50,000/year
Natural Resources Program	This is a superb example of a wildlife/natural resources management program for a DoD facility.	This program established water fowl nesting areas on Bloodsworth Island. Area residents benefit from educational programs.	It is recommended that this very worthwhild program be continued and enhanced if possible.	Enhancements: $20,000/year

coliform contamination. SAV species occurring in the area include widgeon grass and horned pondweed.

NAS - Solomons Annex has little potential for impact other than from small scale erosion of the shoreline. The connection of sanitary sewer lines to the Calvert County STP has eliminated the domestic wastewater treatment at this installation. This installation was not examined further in Phases II or III of this study. The only recommended action for NAS-Solomons Annex relates to the need for improvements in shoreline erosion controls. This recommendation is listed in Chapter 5 of this report.

4.5 REGION 4: TIDAL FRESH POTOMAC RIVER

4.5.1 Tributary/Regional Description

4.5.1.1 Environmental Setting. The tidal freshwater portion of the Potomac River extends from the Fall Line at the Little Falls Dam to the transition zone near Indian Head, Maryland (see Figure 4.6). The entire length of this reach lies within the Coastal Plain. Groundwater resources in the Tidal Freshwater Potomac are available from a variety of geologic formations and aquifers and are in good quantity and quality. The mean tidal range is 2.8 feet at Anacostia and decreases to 1.8 feet at Indian Head.

Washington D.C. is located in the Tidal Freshwater Potomac Region. The Potomac River in this area has historically served as a spawning and nursery area for the estuarine and marine anadromous fishes. Overwintering migratory waterfowl are also found in the area.

Water quality in the Tidal Freshwater Potomac has been severely impacted by urban encroachment, primarily from stormwater runoff and municipal sewage treatment plant discharges. In contrast to Baltimore, Maryland or Norfolk, Virginia, few industrial discharges exist in the Washington D.C. area. This reach of the tidal Potomac has experienced sewage contamination, dissolved oxygen deficiencies, overenrichment with nutrients, contamination with metals, and excessive turbidity. In addition, a large algal bloom in the summer of 1983 may have resulted, in part, from high nutrient levels from upland sources, local urban runoff, and sewage treatment plant discharges. Although stressed conditions still exist in the tidal Potomac, improvements have been made, primarily in wastewater treatment plant performance (e.g., Blue Plains). In recent years, the resurgence of SAV, increased Secchi depth (clarity) measurements, and an increase in fish abundance confirm the general trend in improved water quality conditions.

Aberrations of the primary trophic level (i.e., plant life) have been documented in this area since the 1920's, with invasions of water chestnut, water milfoil, blue-green algae, and, currently, the exotic plant Hydrilla. This indicates the ecosystem has been, and is, trophically imbalanced.

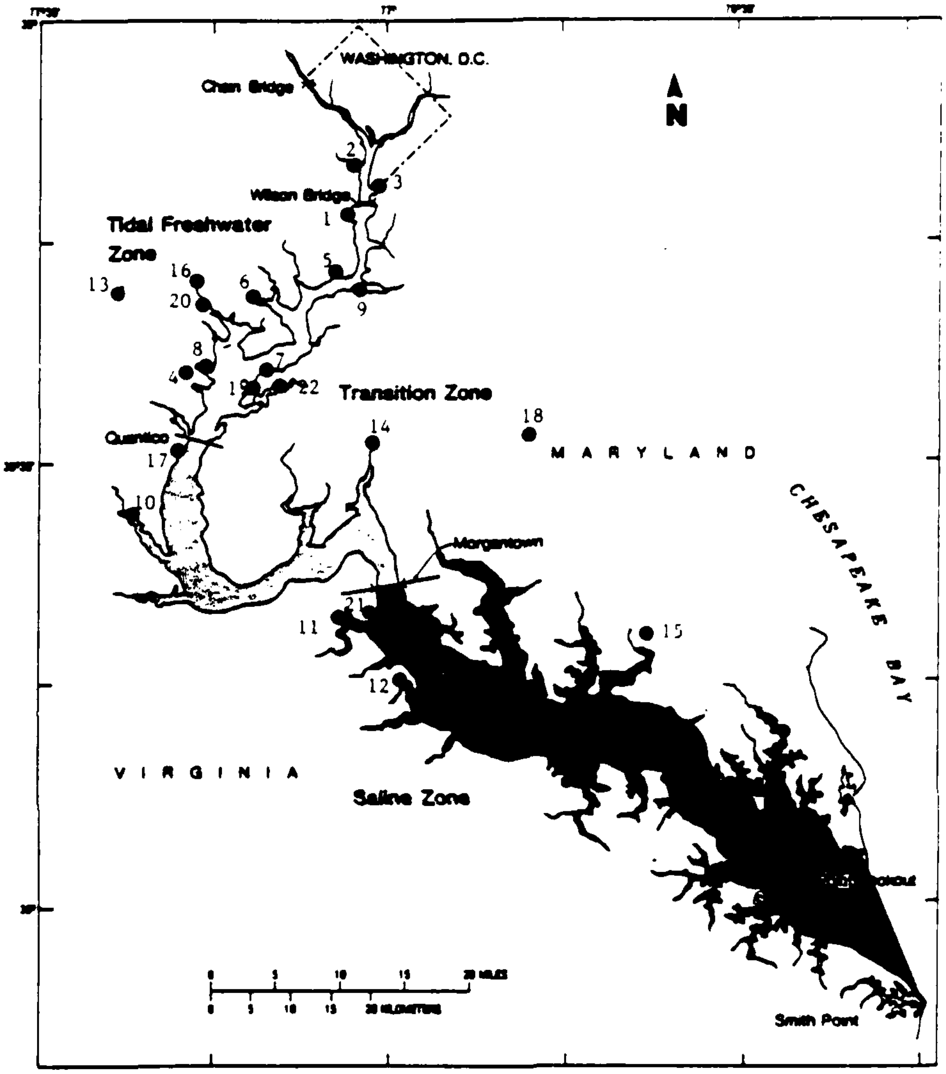


Figure 4.6 Locations of sewage discharges in the Potomac Estuary. See Table 4.13 for a station description of each numbered discharge.

Eighteen DoD facilities are located in the freshwater Potomac River in the vicinity of the District of Columbia as shown in Figure 4.7. Six of these facilities are located on non-tidal freshwater feeder streams, and seven are on tidal reaches. This reach of the Potomac is highly urbanized, politically visible, and has been called "The Nation's River". Consequently, over the past several decades many studies have been undertaken to diagnose and restore the environmental quality of the tidal Potomac.

4.5.1.2 Vicinity Pollutant Loads

Vicinity Point Sources. Municipal sewage treatment plants (STPs) are a major contributor of conventional pollutants to the Tidal Freshwater Potomac, particularly during critical low flow periods of the summer. There are 15 STPs currently discharging to the Tidal Freshwater Potomac as shown in Figure 4.6 and Table 4.13. These STPs have a combined average discharge flow of 447 MGD.

Table 4.14 presents estimates of metals from point sources (STPs) by county into the Potomac estuary (EPA, 1982). (These estimates are not available by zone of the Potomac River.) There are no known major industrial point sources for metals or toxic organics in the Potomac estuary. Although municipal discharges are known to contribute toxic organics, no quantitative information is available to estimate loading rates.

Vicinity Nonpoint Sources. Upland areas represent the greatest source of conventional pollutants, particulary BOD, sediments, and nutrients, to the tidal Potomac. Nonpoint sources to the tidal Potomac can be separated into three major categories: 1) upstream loadings at the Fall Line at Chain Bridge; 2) combined sewer overflows (CSO) from urban areas in the District of Columbia and Alexandria, Virginia; and 3) local (below the Fall Line) tributaries to the tidal Potomac. Table 4.15 presents estimates of upstream pollutant loadings at Chain Bridge over the years 1983 to 1984 (WASHCOG, 1985). Similar estimates for CSOs are not available, however, in 1983 an estimated 2.9 billion gallons ($\approx$ 8 MGD) of untreated overflow were discharged from the District of Columbia's system (O'Brien and Gere, 1984). Similarly, no loadings estimates are available for the local tributaries below the Fall Line. These areas collectively make up about 12 percent of the total Potomac drainage basin area. Since the land use in the lower estuary is similar to that above the Fall Line (primarily rural and agricultural), a rough estimate of nonpoint source pollutant loadings is possible based on the ratio of surface area between a local drainage basin and the entire basin.

Nonpoint sources of metals to the Potomac estuary include atmospheric deposition, urban runoff, and upstream loadings at the Fall Line. Table 4.14 presents estimates of metals loadings from nonpoint sources (above Fall Line) to the Potomac estuary (EPA, 1982). There currently are no similar estimates of nonpoint source loadings of toxics to the Potomac estuary.

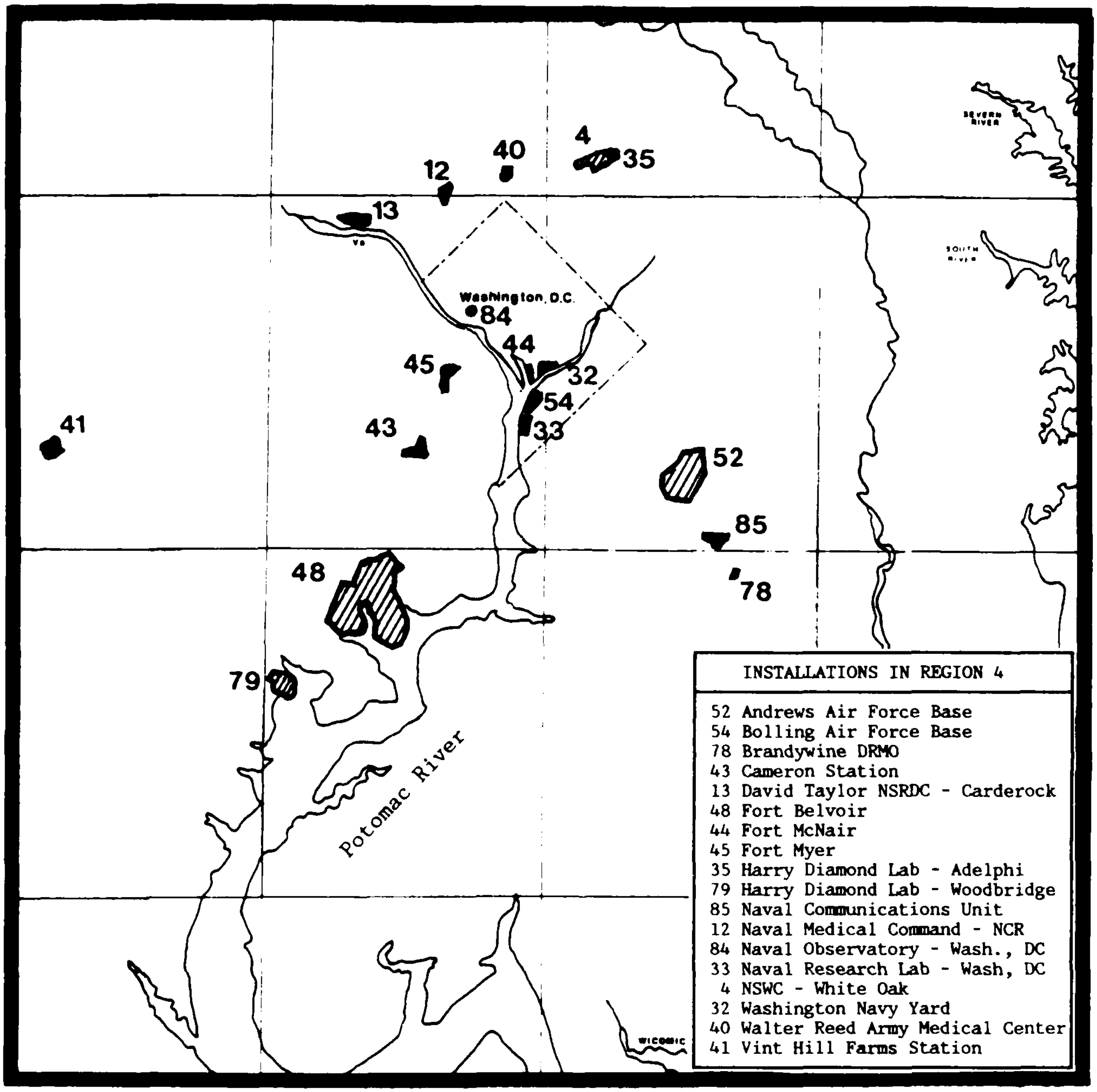


Figure 4.7 Region 4 - Tidal Fresh Potomac River

Table 4.13 Comparison of Point Source Conventional Pollutant Loadings to the Potomac River*

CODE	NPDES	NAME	LOADING (lbs/Day) BOD5	NH3	TKN	TN	PO4	TP	TSS	(MGD) FLOW
2	26531	Arlington	1842	2906	3543	3981	44	97	1753	25.8
3	21199	Blue Plains	3675	5486	2321	36574	151	338	3249	309.4
1	25160	Alexandria	3865	4212	5135	5770	21	48	2360	37.4
9	21539	Piscataway	217	245	125	1633	11	24	601	13.3
5	25372	Little Hunting Cr.	326	419	511	574	3	6	252	3.7
6	25364	Lower Potomac	1669	3685	4493	5048	18.4	41	89	32.7
20	24988	Upper Occoquan	27	32	49	1551	1	2	7	8.1
16	30163	Lorton Correctional	30	70	85	96	14	16	45	0.6
7	21865	Mattawoman	668	499	608	683	135	159	508	4.4
19	20052	Town of Indian Head	58	20	23	28	14	16	58	.3
8	25101	H. L. Mooney	93	891	1087	1221	4	9	86	7.9
4a	24724	Dale Service 1	76	285	347	390	3	6	46	2.5
4b	24678	Dale Service 8	49	93	114	128	1	2	18	0.8
13	27871	Forest Grove	3	5	7	8	0.1	0.1	5	0.05
22	20885	NOS Indian Head	13.4	-	-	-	-	-	13.5	0.3
		Total Tidal Freshwater Zone	12611	18848	18448	57685	420	764	9091	447.25
17	28363	Quantico	44	164	6	225	1	2	36	1.5
10	60968	Aquia	23	152	185	208	1	3	11	1.4
18	23914	Southern Correctional	4	2	3	3	1	1	4	0.02
14	20524	LaPlata	127	69	84	94	30	36	127	0.6
11a	28517	Dahlgren, Town of	6	2	3	3	0.6	1	5	0.02
11b	26514	Dahlgren, Town of	21	7	10	11	3	4	13	0.06
21	21067	Dahlgren, NSWC	16.7	-	-	-	-	-	10.2	0.18
		Total Transition Zone	242	396	291	544	36.6	47	206	3.78
12	26409	Colonial Beach	42	47	57	64	19	22	57	0.4
15	24767	Leonardtown	52	28	34	39	11	13	52	0.3
		Total Saline Zone	94	75	91	103	30	35	109	0.7
		Total Potomac Estuary	12947	19319	18830	58332	487	846	9406	451.7

*Based on summer 1984/1985 conditions reported by USEPA (J. Macknis, Personal Communication)

Table 4.14 **Estimated** Loadings of Metals to Potomac Estuary*
Loadings (lbs/day)

County	Cr	Cd	Pb	Cu	Zn	Fe	Mn	Ni
Charles	0.0	0.0	0.0	0.0	0.0	0.0	-	-
Prince Georges	88.3	1.8	49.6	41.7	104.7	229.9	-	-
St. Mary's	0.0	5.4	1.8	2.4	7.3	15.7	-	-
Alexandria	75.0	1.2	50.8	35.7	82.9	182.7	-	-
Prince William	93.2	1.8	54.4	44.2	109.5	240.2	-	-
Subtotal	256.5	10.2	156.6	124.0	304.4	668.5	-	-
atmospheric	-	1.8	17.5	14.5	423.5	44.8	-	-
urban runoff	24.2	6.1	302.5	24.2	175.4	2861.3	42.4	60.5
upstream at Fall Line	635.2	24.2	617.0	520.2	1947.9	5075.4	11693.3	659.4
Subtotal	659.4	32.1	937.0	558.9	2546.8	7981.5	11735.7	719.9
TOTAL	915.9	42.3	1093.6	682.9	2851.1	8650.0	11735.7	719.9

*EPA (1982)

Table 4.15

COMPARISON OF ESTIMATED UPSTREAM POLLUTANT LOADINGS
Potomac River at Chain Bridge, 1983-1984 *

	10^6 lbs							10^3 tons	AVG.DAILY
	TN	OXN	NH3	TKN	TP	OP	TSP	TSS	FLOW cfs
January	4.1	2.7	0.08	1.4	0.27	0.06	0.10	52	10,460
February	20.1	9.6	0.77	10.5	2.49	0.33	0.51	806	39,460
March	12.8	8.4	0.30	4.5	0.95	0.27	0.33	240	34,430
April	15.8	9.9	0.43	5.9	1.18	0.31	0.44	286	47,860
May	8.0	5.2	0.18	2.7	0.51	0.16	0.21	100	19,930
June	1.7	1.0	0.03	0.7	0.10	0.02	0.04	15	5,433
July	2.3	1.4	0.05	0.9	0.16	0.04	0.07	30	6,641
August	4.8	2.2	0.13	2.6	0.61	0.10	0.16	157	11,350
September	1.0	0.6	0.02	0.4	0.05	0.01	0.02	7	3,250
October	1.0	0.7	0.03	0.4	0.07	0.03	0.04	10	3,179
November	2.0	1.1	0.04	0.9	0.21	0.05	0.07	47	4,986
December	4.5	2.8	0.08	1.7	0.37	0.08	0.12	80	11,910
1984 Total	78.1	45.6	2.13	32.6	6.98	1.47	2.11	1830	
1983 Total	64.2	38.5	1.84	26.1	5.58	1.17	1.52	1792	
% Change 1983-1984	+22%	+18%	+11%	+25%	+25%	+26%	+39%	+2.1%	

*WASHCOG (1985)

4.5.1.3 Relative Comparison to DoD Installation Pollutant Loads

Point Sources. Of the 18 DoD installations in the Tidal Freshwater Potomac, only one, Vint Hill Farms, operates a sewage treatment plant. All others are connected to a regional sewage treatment system. The Vint Hill Farms STP discharges about 0.17 MGD to South Run, a tributary to the Occoquan drainage basin in Virginia.

Nonpoint Sources. On a regional scale, the combined 18 DoD installations contribute a relatively insignificant loading of nonpoint source pollutants to the Tidal Freshwater Potomac compared to the surrounding contributions. Based on land surface area, the DoD installations represent only about two-tenths of one percent of the total Potomac River drainage area (including above and below the Fall Line). However, on a local scale, nonpoint source contamination primarily from stormwater runoff has been identified as an area of concern for many of these installations bordering directly on surface waters. These concerns are not unique to the DoD installations, especially in the extensively urbanized area of the Tidal Freshwater Potomac.

4.5.1.4 **Summary of DoD Impacts on the Tidal Freshwater Potomac**. The locations of the 18 DoD installations in this region in relation to the Chesapeake Bay are shown in Figure 4.8. All but five of these installations were estimated during Phase I of this study to represent a likely insignificant potential for water quality impacts. The remaining five (NSWC-White Oak, Vint Hill Farms, Fort Belvoir, Andrews AFB, and DTNSRDC Carderock) were estimated to represent a poorly defined but likely significant potential for adverse water quality impacts by virtue of their activities and/or proximity to surface waters, and thus were examined in greater detail during Phase III of this study.

Table 4.16 presents the results of the final screening of all 18 DoD installations in this region. Four of the 18 installations (NSWC-White Oak, Vint Hill Farms, Fort Belvoir, and Andrews AFB) were estimated to represent a poorly defined but likely significant adverse impact potential for local water quality and biological resources. Areas of concern for these four installations include stormwater runoff and poorly characterized minor industrial discharges to storm drains, possible toxics in sewage treatment effluent (Vint Hill Farms), unknown status of underground storage tank integrity and/or fuel spill containment protection (Fort Belvoir and Andrews AFB), erosion and sedimentation (Fort Belvoir and Andrews AFB), and potential contaminants leaching to surface waters from inactive waste disposal sites. In general, little data exist to adequately quantify pollutant sources and potential impact levels from these activities.

The remaining installations (see Figure 4.8) were judged to represent an insignificant potential for water quality impacts, based on the available information. DTNSRDC Carderock, originally estimated to represent a poorly defined but likely significant impact potential during Phase I, was reassessed during Phase III and reassigned to the impact category of "poorly defined but likely insignificant impact potential". Available information

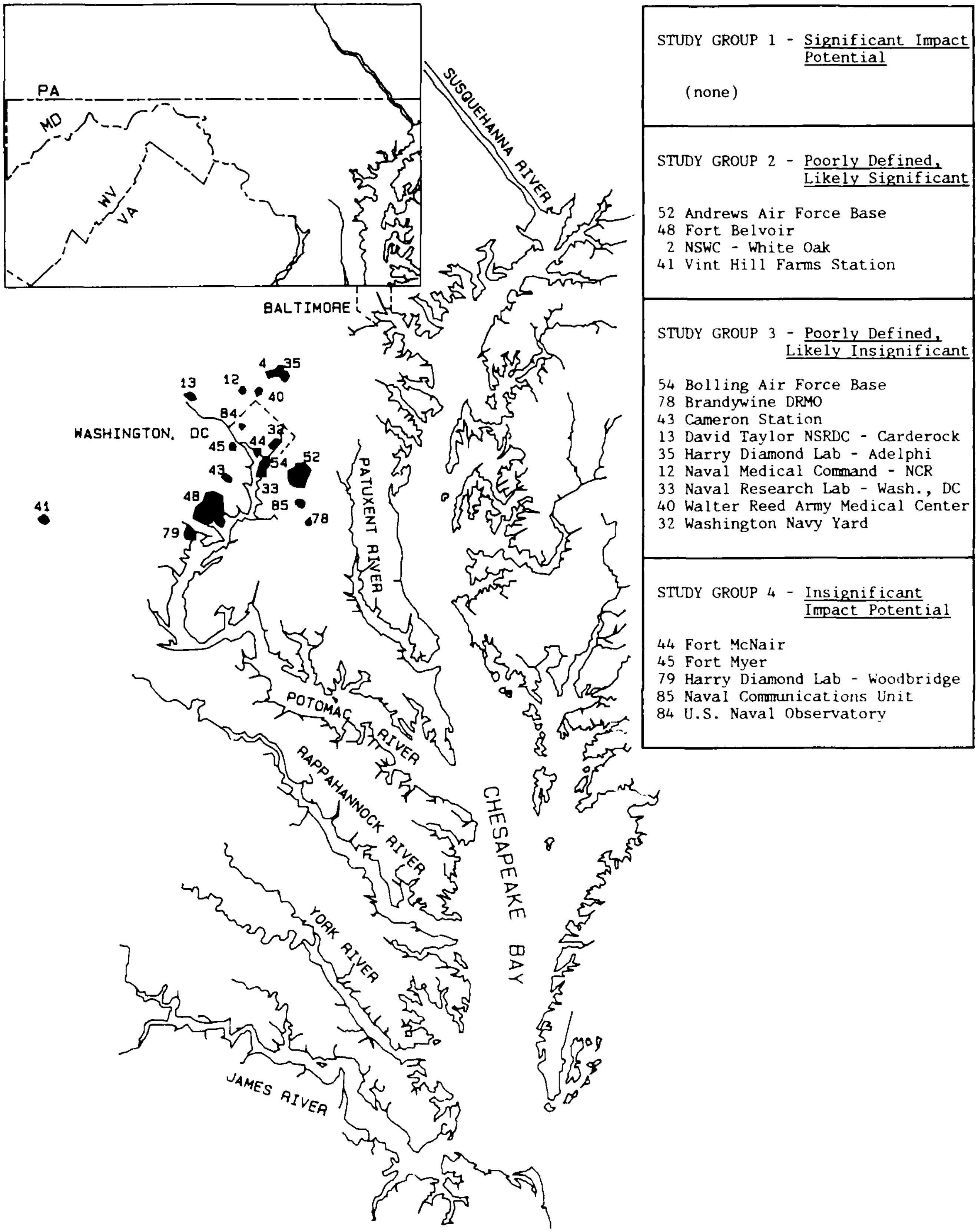


Figure 4.8 Location of DoD Installations in the Tidal Fresh Potomac Region and Summary of Installation Impact Potential.

Table 4.16 Summary of Final Screening for Installations in the Tidal Fresh Potomac Region

ON-SITE SCREENING CRITERIA (ON-SITE IMPACT POTENTIAL)

ID	Branch	Installation Name	NON-POINT SOURCES: 1. Erosion/Sedimentation	2. Impervious Area Runoff	3. Combined Storm Drains	4. Shoreline Erosion	POINT SOURCES: 5. Sewage Treatment	6. Industrial Waste Treat	7. Intermitt Sewage Treat	HAZARDOUS/TOXIC MATERIALS: 8. Refueling Operations	9. Munitions Operations	10. Chemical Operations	11. Pesticides	12. Vehicle Maintenance
4	NAVY	Nav Sur Wea Ctr-W Oak	-	-	·	·	+	-	-	·	·	·	+	·
12	NAVY	Naval Med. Com-NCR	⊕	·	-	·	·	-	·	-	·	·	·	·
13	NAVY	David Taylor-Carder.	·	·	·	·	·	·	·	·	·	·	·	·
32	NAVY	Washington Navy Yard	·	-	·	·	·	·	·	-	·	·	-	·
33	NAVY	Naval Research Lab	·	-	·	+	·	-	·	·	·	·	+	·
35	ARMY	HDL - Adelphi	+	·	·	·	·	+	·	·	·	·	·	·
40	ARMY	Walter Reed Med Ctr.	-	+	·	·	·	·	·	·	·	·	·	·
41	ARMY	Vint Hill Farms Sta.	·	·	·	·	Θ	-	·	·	·	·	·	⊕
43	ARMY	Cameron Station	·	·	·	·	·	·	·	·	·	·	+	·
44	ARMY	Fort McNair	·	·	·	·	·	·	·	-	·	·	+	·

ID	13. Ship Maintenance	14. Solid Waste Disposal	15. Hazardous Waste	16. SPCC Status	17. Abandoned Sites	18. LUST Status	ENVIRONMENTAL PROGRAMS: 19. Forestry Mgmt. Plan	20. Wildlife Mgmt. Plan	21. Soil Conservation Plan	22. Stormwater Mgmt. Plan	23. Wetlands Mgmt. Plan	24. Shoreline Erosion Plan
4	·	·	+	+	-	·	+	+	+	-	·	·
12	·	·	-	-	·	·	·	·	·	-	·	·
13	·	·	-	+	·	-	·	·	·	-	·	·
32	·	·	·	-	·	-	·	·	-	+	·	+
33	·	·	+	+	·	·	·	·	+	+	·	+
35	·	·	+	+	·	-	·	·	+	-	·	·
40	·	·	·	·	-	·	·	·	+	+	·	·
41	·	Θ	+	-	Θ	-	+	·	+	+	·	·
43	·	·	-	+	·	-	·	+	+	+	·	·
44	·	·	·	·	·	·	·	·	·	·	·	+

ID	VICINITY SCREENING CRITERIA — RELATIONSHIP TO LOCAL ENVIRONMENT: 25. Shellfish Areas	26. SAV Areas	27. Fish Spawning Areas	28. Wetlands Areas	29. Waterfowl Nesting	30. Endangered Species	31. Relative Local Impact	STUDY GROUP — IMPACT POTENTIAL: 1. Significant	2. Poorly Defined, Sig.	3. Poorly Defined, Insig.	4. Insignificant
4	·	·	-	·	·	·	-		X		
12	·	·	·	·	·	·	-			X	
13	·	·	·	·	·	·	·				X
32	·	·	-	·	·	·	·			X	
33	·	·	-	·	·	·	·			X	
35	·	·	·	·	·	·	+			X	
40	·	·	·	·	·	·	·			X	
41	·	·	·	·	·	·	-		X		
43	·	·	·	·	+	·	+			X	
44	·	·	·	·	·	·	+				X

KEY: Impact Category 1: { Θ Significant Impact Potential (Adverse)
⊕ Significant Impact Potential (Beneficial)

Impact Category 2: { - Unknown or Poorly Defined Impacts (Adverse)
\+ Unknown or Poorly Defined Impacts (Beneficial)

Impact Category 3: · Insignificant Impact Potential (Adverse or Beneficial)

Table 4.16
(Continued)

ID	Branch	Installation Name	ON-SITE SCREENING CRITERIA (ON-SITE IMPACT POTENTIAL)																								VICINITY SCREENING CRITERIA							STUDY GROUP			
			NON-POINT SOURCES				POINT SOURCES			HAZARDOUS/TOXIC MATERIALS											ENVIRONMENTAL PROGRAMS						RELATIONSHIP TO LOCAL ENVIRONMENT							IMPACT POTENTIAL			
			1. Erosion/Sedimentation	2. Impervious Area Runoff	3. Combined Storm Drains	4. Shoreline Erosion	5. Sewage Treatment	6. Industrial Waste Treat	7. Intermitt Sewage Treat	8. Refueling Operations	9. Munitions Operations	10. Chemical Operations	11. Pesticides	12. Vehicle Maintenance	13. Ship Maintenance	14. Solid Waste Disposal	15. Hazardous Waste	16. SPCC Status	17. Abandoned Sites	18. LUST Status	19. Forestry Mgmt. Plan	20. Wildlife Mgmt. Plan	21. Soil Conservation Plan	22. Stormwater Mgmt. Plan	23. Wetlands Mgmt. Plan	24. Shoreline Erosion Plan	25. Shellfish Areas	26. SAV Areas	27. Fish Spawning Areas	28. Wetlands Areas	29. Waterfowl Nesting	30. Endangered Species	31. Relative Local Impact	1. Significant	2. Poorly Defined, Sig.	3. Poorly Defined, Insig.	4. Insignificant
45	ARMY	Fort Myer	•	+	-	•	•	•	•	•	•	•	•	•	•	•	•	+	•	•	•	•	+	+	•	•	•	•	•	•	•	•	•				X
48	ARMY	Fort Belvoir	+	-	-	•	•	-	•	-	-	+	+	+	•	+	Θ	-	Θ	-	+	+	+	Θ	+	-	•	-	-	-	⊕	-	-		X		
52	USAF	Andrews AFB	-	-	+	•	•	•	•	-	•	•	+	-	•	•	-	-	-	-	•	•	-	+	•	•	•	•	-	•	•	•	-		X		
54	USAF	Bolling AFB	•	-	•	•	•	•	•	-	•	•	+	•	•	•	•	-	-	-	•	•	•	-	•	+	•	+	•	•	•	•	-			X	
78	USAF	Brandywine DRMO	•	•	•	•	•	•	Θ	•	•	•	•	•	•	•	-	Θ	-	•	•	•	•	•	•	•	•	•	•	•	•	•	•			X	
79	ARMY	HDL - Woodbridge	+	•	•	+	•	•	+	•	•	•	•	•	•	•	•	+	⊕	+	+	⊕	⊕	+	⊕	+	+	•	⊕	⊕	⊕	⊕	+				X
84	NAVY	Naval Observatory	•	•	•	•	•	•	•	•	•	•	+	•	•	•	•	•	•	•	+	⊕	•	•	•	•	•	•	•	•	•	•	•				X
85	NAVY	Naval Com. Unit	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	+	•	•	-	•	•	•	•	•	•	•	⊕	•	•	•				X
		Total Number of Installations per Study Group																																0	4	8	6
Score Totals		Θ	0	0	0	0	1	0	1	0	0	0	0	0	0	1	1	1	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0				
		-	3	6	3	0	0	5	1	6	1	0	1	1	0	0	5	6	5	8	0	1	2	5	0	1	0	1	5	1	0	1	6				
		⊕	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	2	1	0	1	0	0	0	1	2	2	1	0				
		+	3	2	1	2	1	1	1	0	0	1	8	1	0	1	4	7	1	1	5	3	8	8	1	5	1	1	0	0	1	1	4				
		•	11	10	14	16	16	12	15	12	17	17	9	15	18	16	8	4	9	9	13	12	7	4	16	12	17	16	12	15	15	15	8				

for DTNSRDC indicates that the storm drainage system is not discharging trace organics, as originally believed, and other concerns (nonconforming hazardous waste storage) have not resulted in direct impacts on surface waters.

The region of influence of DoD installations in the Tidal Fresh Potomac region appears to be limited to the immediate vicinity of each installation. Compared to surrounding point and nonpoint pollutant sources, the installations contribute a relatively minor loading of conventional pollutants (BOD, nutrients, sediments) to the Chesapeake Bay. The most beneficial programs at DoD installations in this region have included the elimination of sewage treatment systems (Fort Belvoir, Andrews AFB), implementation of erosion controls, provision of tight pesticides management, updating and implementing effective SPCC programs, preservation of large undeveloped areas which act as buffer zones for surface water habitat protection (Fort Belvoir, HDL-Woodridge, Naval Communications Unit), and development and implementation of progressive natural resources and land management programs.

Ongoing areas of concern relate primarily to activities that are difficult to control or regulate. They include: overland runoff and erosion; potential contaminant migration from inactive waste disposal sites; and intermittent and poorly defined industrial discharges into storm drains. The following sections summarize findings and recommendations for the 18 installations in this region.

4.5.2 Installation 4: Naval Surface Weapons Center - White Oak (WO)

4.5.2.1 **General**. White Oak is located about five miles north of Washington, D.C. in Silver Spring, Maryland. The 732 acre site is located within the Paint Branch drainage basin; a 12-mile long tributary of the Northeast Branch Anacostia River which is a tributary of the Potomac River. Water quality in Paint Branch is good and supports a naturally reproducing brown trout population. In 1982, WO's domestic sewer system was connected to the Washington Suburban Sanitation Commission (WSSC) regional sewer system and the installation's sewage treatment plant was closed. While WO's STP was in operation, brown trout were only found upstream of the STP outfall in Paint Branch. Since the plant's closure, brown trout are now found downstream of the former outfall location. WO is also drained by one unnamed perennial stream and eight intermittent streams. WO is the principal Navy research, development, test, and evaluation center for ordnance technology, concepts, and development.

4.5.2.2 **Summary of Impact Potential and Recommended Actions**. WO was screened in Study Group 2 in Phase I of this study because of: the potential for industrial wastewater reaching local surface waters; the presence of 37 remote septic systems; seven NACIP confirmation sites; and WO's proximity to Paint Branch. The installation assessment methodology was applied to WO during Phase III to better define the likely character and extent of WO's impact on local receiving waters. As a result of this analysis, WO remains

in Study Group 2. Table 4.17 summarizes the areas of concern and recommended actions identified for WO. As shown in this table, areas of concern include NPDES violations for oil and grease (O&G) at outfalls 002 and 003; oil and grease violations during rain events at NPDES outfall 007; potential for stormwater runoff to carry sediments and other urban washoff to Paint Branch; and potential for migration of PCBs, solvents, explosive compounds, and lead from NACIP abandoned waste sites to surface waters. No data exists along Paint Branch to determine the effects of WO activities on surface water quality. Recommended actions for WO include:

- o Establish a service schedule for pumping out the oil/water separator above outfalls 002 and 003 to prevent future releases of O&G to surface waters.
- o Install an oil/water separator to intercept oily runoff from the parking area above outfall 007.
- o Establish a periodic stream water quality sampling program for Paint Branch and other streams on the base.
- o Review the NACIP Phase II results and determine need for appropriate remedial measures.
- o The practice of no agricultural outleases on the facility should be continued as a means of reducing the area's nutrient loading from farmlands.
- o Tie in the remote septic systems to the WSSC sewer system. (Note: a project to complete this action by 1989 has begun.)

4.5.3 Installation 12: Naval Medical Command National Capitol Region (NMCNCR)

4.5.3.1 General. The NMCNCR occupies approximately 243 acres and is located in Bethesda, Maryland, on Wisconsin Avenue immediately south of the Capitol Beltway (Rt. 495). All storm drainage goes through a man-made pond which traps sediment and pollutants, thus minimizing the impact on the receiving water, Rock Creek. The NMCNCR is the regional Command Headquarters for Naval Medical activities. Activities include the Naval Hospital, medical research and development, and medical and health sciences education and training.

4.5.3.2 Summary of Impact Potential and Recommended Actions. The screening data for NMCNCR are summarized in Tetra Tech (1986). The NMCNCR has been screened in Study Group 3, having a poorly defined but likely insignificant impact potential (see Table 4.16). This determination is based on the fact that there are no major waste discharges on the installation and no locally significant ecological resources. However, there are a number of concerns that may require further consideration. These concerns include:

Table 4.17 Summary of Areas of Concern and Recommendations for Naval Surface Weapons Center - White Oak

ACTIVITY/POLLUTANTS OF CONCERN	ONSITE	OFFSITE/VICINITY	RECOMMENDATIONS	ESTIMATED COST
Oil/Water Separator / oil and grease	O&G violations of NPDES permit at outfalls 002 & 003 has been attributed to failure to pump out accumulated oil in oil/water separator.	Paint Branch is a Class II natural trout stream having a self-sustaining population of brown trout. Water quality further downstream in Anacostia River is poor.	A service schedule should be instituted for the oil water separator to avoid future releases of O&G to surface waters.	$15,000/year
Parking Lot Runoff / oil & grease	O&G violations at NPDES outfall 007 occur during rain events. The source has been identified as runoff from a parking area.	Same as above.	Oil/water separator should be installed to intercept oily runoff from parking area before it can reach surface waters.	$10,000 - $20,000
Stormwater Runoff / petroleum hydrocarbons, heavy metals, and toxics	Stormwater runoff from the base has potential to carry sediments and urban washoff to surface waters of Paint Branch.	Same as above.	Establish periodic stream water quality and sediment sampling program for Paint Branch and other streams on NSWC White Oak	<u>Monitoring</u>: $25,000/year
NACIP Confirmation Sites / PCBs, solvents, explosive compounds, lead	Potential exists for groundwater contamination and migration to surface waters both on base and off base.	No water quality data exist for on base streams to confirm or deny presence of these contaminants.	Continue with confirmation studies in accordance with the Navy's Installation Restoration Program.	Costs unknown
Remote septic tanks / contamination of ground water	There are remote septic tanks at NSWC White Oak which have potential to pollute ground water.	Potential exists for contaminated ground water to migrate off base.	Continue with ongoing projects to connect all known septic systems and leaching wells to WSSC sanitary system by 1989.	$100,000 - $200,00

a. The lack of a stormwater management plan for the installation. A significant (40%) portion of the installation's surface area is impervious and there is no plan to control or monitor runoff quantity or quality. Also, the storm drainage system drains several buildings including laboratories and maintenance activities. Neither a NPDES permit nor any monitoring data exist for this drainage system, however, a permit has been recently applied for.

b. The potential need for pretreatment of domestic/institutional waste entering the WSSC system. Currently, the WSSC and CHESDIV are separately investigating the various waste streams on the facility to determine pretreatment requirements, if any. No results are yet available.

c. A contract to prepare a new SPCC Plan was awarded in June 1987. Development of plans and specifications for spill procedures and facilities for fuel transfer and storage will follow.

d. The RCRA Part B Permit submitted in 1985 is still under review. The existing hazardous waste storage areas are not in full compliance with regulatory requirements. The storage area is currently being upgraded to meet state requirements.

Although the NMCMCR was not recommended for further detailed analysis in Phase III, the above concerns need to be addressed. Recommended actions for NMCMCR include stormwater runoff control, potential pretreatment of wastewater, and improved implementation of hazardous materials management programs. Recommended actions are summarized in Chapter 5.

4.5.4 Installation 13: David Taylor Naval Ship Research and Development Center (DTNSRDC), Carderock Laboratory

4.5.4.1 General. The DTNSRDC Carderock Laboratory covers approximately 184 acres and is located at Bethesda, Maryland about 5 miles northwest of Washington, D.C. near the north bank of the Potomac River. The DTNSRDC facility is dedicated to the research and development of ship hulls and aerodynamic shapes.

4.5.4.2 Summary of Impact Potential and Recommended Actions. In Phase I of this study, DTNSRDC was screened in Study Group 2, based on the potential for nonpoint source runoff, the possibility of toxics present in the storm drainage discharge, and noncompliance of hazardous waste storage and handling procedures. The installation assessment methodology was applied to DTNSRDC during Phase III to better define the likely character and extent of DTNSRDC's impact on local receiving waters. As a result of this analysis, DTNSRDC has been reassigned to Study Group 3 (poorly defined but likely insignificant impact potential). A recent study by NEESA examined the storm drainage discharges at DTNSRDC for the presence of toxic organics, however none were detected. Table 4.18 summarizes the areas of concern and

Table 4.18 Summary of Areas of Concern and Recommendations for DTNSRDC, Carderock

ACTIVITY/POLLUTANTS OF CONCERN	ONSITE	OFFSITE/VICINITY	RECOMMENDATIONS	ESTIMATED COST
Stormdrains/ Oil and grease, TSS, pH	Nine industrial outfalls under NPDES permit show good compliance except for pH. No organic toxics found. Periodic flooding occurs during heavy rainstorms.	Limited data in Potomac River downstream of Carderock indicates good water quality based on conventional constituents.	Develop a stormwater management plan for Carderock.	Develop plan: $20,000 Monitoring: $20,000/year
Hazardous Waste Storage and Handling	No permitted storage facility exists. Hazardous waste is stored at generation site. Have experienced difficulty scheduling DLA pickup. No spills reported. RCRA Part B filed and under review.	-	Provide a conforming hazardous waste storage facility and implement proper handling procedures.	$150,000
Underground Storage Tanks	Several UST exist. One ruptured tank recently replaced.	-	Continue with plan to implement tank testing scheduled for FY88.	$500/tank

recommended actions identified for DTNSRDC. As shown, remaining areas of concern include lack of a stormwater management plan, lack of a conforming hazardous waste storage area and questionable HM/HW handling procedures, and the need to test underground storage tanks (UST) for leaks. Recommended actions for DTNSRDC include:

- Develop a stormwater management plan which includes periodic dry and wet weather monitoring of stormdrains for oil and grease and TSS to determine the possible need for sediment and oil/water separators;

- Construct a RCRA conforming hazardous waste storage facility (a RCRA Part B permit has been filed by DTNSRDC); and

- Implement an UST testing program (Note: a testing program is scheduled for FY88).

4.5.5 Installation 32: Washington Navy Yard (WNY)

4.5.5.1 General. The WNY is located in the District of Columbia on 187 acres of property. WNY has two detachments, the Arlington Service Center (ASC) covering 40 acres in Arlington, Virginia and the Anacostia Annex (AA) covering 200 acres, in the District of Columbia. The WNY and detachments drain into the Anacostia River, a tributary of the Potomac River. The primary mission of WNY is the support of various Naval commands through its administrative offices.

4.5.5.2 Summary of Impact Potential and Recommended Actions. The screening data for WNY are summarized in Tetra Tech (1986). Based on the screening criteria, WNY is judged to fall within Study Group 3, having a poorly defined but likely insignificant potential impact level on the ecological resources of the Chesapeake Bay (see Table 4.16). Major considerations for this judgement are presented below:

a. There have been no previous Environmental Assessments of WNY to assess past and present mission activities. Staff personnel have reported uncovering abandoned holding tanks or spills during the renovation of buildings.

b. WNY and AA are located on the Anacostia River. ASC is landlocked. The large area of impervious surface at WNY can result in stormwater runoff contamination due to oil and fuels, exhaust residue, heavy metals, and salts on the roadways and parking lots. The condition of oil/water separators in the stormwater sewers at WNY was reported to be questionable.

c. Refueling operations include three gas stations and an emergency fuel barge at WNY with a capacity of 350,000 gallons of No. 2 fuel oil. Containment booms are available in case of spills or leaks. The barge is the potential site of a large oil spill on the Potomac River. AA is currently testing five underground storage

tanks (UST) for the origin of a fuel leak on site. One tank at WNY has been tested and all are planned for testing under FY88 CHESDIV contract.

d. Pesticides are presently being stored in a non-conforming area at WNY. AA will be the site of a conforming building, the design of which has been recently completed. The hazardous waste storage area is in compliance with regulations for storing PCB transformers. WNY will *be applying for a RCRA Part B storage* permit.

e. Ecological resources within one tidal excursion of WNY and AA include herring, shad, and white perch spawning areas.

Although WNY has poorly defined potential impacts, especially with regard to the lack of a environmental assessment study, the impacts are likely to be insignificant. Therefore, WNY was not examined further in Phases II and III of this study. Recommended actions for WNY include control of stormwater runoff, spill prevention and control, UST testing, and pesticides handling and storage. Recommended actions are summarized in Chapter 5.

4.5.6 Installation 33: Naval Research Lab (NRL)

4.5.6.1 **General**. NRL is located in southwest Washington, D.C. along the Potomac River and immediately adjacent to the Blue Plains Sewage Treatment Plant. Covering 129 acres, NRL's primary mission is to conduct a broadly-based, multidisciplinary program of scientific research and advanced technological development, including new and improved materials, equipment, techniques, systems, and related operations for the U.S. Navy.

4.5.6.2 Summary of Impact Potential and Recommended Actions. NRL's screening data are summarized in Tetra Tech (1986). Based on the screening criteria, NRL has been placed in Study Group 3, having a poorly defined but likely insignificant impact potential on ecological resources of the Chesapeake Bay (see Table 4.16). This screening was based on the following considerations:

a. Approximately 50% of the total surface area of the installation is impervious. Stormwater outfalls draining this area empty directly into the Potomac River and may carry oils, salts, fuels, residues, heavy metals, and exhaust particulates from the parking lots and roadways.

b. Shoreline erosion and soil conservation programs appear to be effectively implemented. Construction projects must use sediment control devices and methods.

c. Industrial pretreatment of wastewater is required before discharge into Blue Plains Sewage Treatment Plant. *Reportedly, the only* waste treatment process in use is the neutralization of plating

waste. Although no NPDES is required, NRL must submit compliance reports to EPA. Current compliance status is unknown.

d. Radioactive materials are used in research at NRL. The use, storage, and disposal of all material and generated waste is monitored and handled by the Health Physics Staff.

e. NRL uses explosives in controlled laboratory conditions and has a limited quantity stored on site.

f. Shad, herring, and white perch spawning areas as well as SAV and waterfowl are located in the Potomac River near NRL. The water quality is affected from offsite sources by accelerated sediment deposition, nutrient enrichment, and high levels of toxic metals.

NRL has a relatively minor impact on the Potomac River. The lab was not examined further in Phase III of this study. Recommended actions for NRL include stormwater runoff management and industrial pretreatment. Recommended actions are summarized in Chapter 5.

4.5.7 Installation 35: Harry Diamond Lab - Adelphi (HDL)

4.5.7.1 **General.** HDL is located about 10 miles north of Washington, D.C., and is divided by the county lines of Montgomery County (82 acres) and Prince George's County (54 acres). HDL drains to Paint Branch Creek and ultimately into the Potomac River. The principal mission at HDL is advanced research and development of technically superior, highly reliable weapons for the U.S. Navy.

4.5.7.2 **Summary of Impact Potential and Recommended Actions.** HDL screening data are summarized in Tetra Tech (1986). Based on the screening criteria, HDL was judged to fall within Study Group 3, having a poorly defined but likely insignificant impact potential on Chesapeake Bay ecological resources (see Table 4.16). Major considerations for this judgement include the following:

a. During heavy rainfall events, the Paint Branch Creek floods, causing extensive damage to the installation fence, a patrol road, a bridge, and erosion along the creek. A complete survey is required of the flood prone areas so that a flood plan can be initiated.

b. All domestic wastewater generated at HDL is discharged into the Washington Suburban Sanitary Commission (WSSC).

c. HDL operates five industrial wastewater pretreatment plants. Three contain neutralization sumps. The other two utilize precipitation and clarification processes primarily to remove copper, chrome, and cyanide. The combined treatment capacity of the two plants is 0.09 MGD. Onsite wastewater is generated by plating and circuit board operations, photographic processing,

and general laboratory operations. Sludges are hauled off-site for disposal by the American Recovery Company, Inc. Effluent from the pretreatment processes is combined with the sanitary sewer lines and discharged into WSSC. Wastewater flows to WSSC are approximately 0.06 MGD and meet all quality standards for WSSC. One NPDES permit is for Building 500, the Aurora Facility. The Aurora Facility uses 1.6 million gallons of mineral oil in ionizing radiation research. A continuous stream of water flows from a natural spring located under the building (flow is approximately 0.03 MGD). The water from the spring is contaminated by occasional mineral oil spills. Treatment is by oil/water separators. Non-compliance is due to the naturally occurring low pH of the spring water.

d. Hazardous waste storage facilities are in full compliance with RCRA Part B regulations except for the 90 day limit for pickup and disposal. The current contractor has not been timely in removing the hazardous material off-site. Contracts are through the DRMO. HDL stores, uses, and treats large quantities of radioactive material.

e. HDL personnel have reported an occasional oily sheen at the stormwater outfall weir of Paint Branch Creek. This is possibly due to POL leaking from underground storage tanks beneath a parking lot next to the boiler plant. Also, stormwater runoff from the parking lot may affect the aquatic ecology of Paint Branch Creek by carrying oils, salts, fuels, residues, heavy metals, and exhaust particulates. The main impacts of the leaking POL and stormwater runoff from parking lots are toxic effects and siltation. Paint Branch Creek above the Capital Beltway (Rt. 495) is designated by the State as a Class III natural trout stream.

HDL has a relatively minor impact potential on Paint Branch Creek because of its limited pollutant loadings on the area. HDL was not examined further during Phase III of this study. Recommended actions for HDL include the need for erosion control along Paint Branch Creek, assurance of compliance with hazardous waste storage and removal regulations, and UST testing. Recommended actions are summarized in Chapter 5.

4.5.8 Installation 40: Walter Reed Army Medical Center (WRAMC)

4.5.8.1 General. WRAMC is located in the northern section of Washington, D.C. and contains the main hospital complex. Forest Glen, a WRAMC annex, is located approximately 3 miles north of WRAMC. Glen Haven is a housing complex for WRAMC and is located approximately 4 miles north of WRAMC, east of Wheaton, Maryland. WRAMC and its detachments are within the Potomac River drainage basin. The primary mission of WRAMC is to operate a tertiary care medical center, provide health services on a worldwide referral basis, conduct graduate medical educational and professional technical programs, and conduct clinical investigations.

4.5.8.2 __Summary of Impact Potential and Recommended Actions.__ The screening data for WRAMC are summarized in Tetra Tech (1986). Based on the screening criteria, WRAMC is judged to fall within Study Group 3, having a poorly defined but likely insignificant impact potential on the ecological resources of the Chesapeake Bay (see Table 4.16). The major considerations for this judgement include the following:

a. WRAMC's urban setting and academic and medical activities result in relatively limited impacts on water quality in the area. Washington Suburban Sanitary Commission provides domestic wastewater treatment. Stormwater runoff probably contains typical urban pollutants such as oils, salts, fuels residues, and exhaust particulates from the parking lots and roadways.

b. Forest Glen has had an erosion problem at a large fill operation which has created siltation problems in Sligo Creek. A state required permit and erosion control program, however, was implemented. Forest Glen was the site of a landfill that was active approximately 15 years ago. The landfill was not included in the IRP for WRAMC. Recent excavation at the landfill uncovered some of its contents. There is presently no monitoring of the site for possible migration of pollutants.

c. WRAMC recently discovered that some of the sanitary and stormwater sewers from the 1800's were crossed at the main site. The National Parks and Planning Commission is funding a project to correct the situation.

d. Hazardous waste handling and disposal is an area of concern at WRAMC. Waste handling procedures consist of storing the generated waste at a designated area on each floor of a building. Because of the decentralized storage procedure, the contractor must service each storage area when pickups are made. All flammable hazardous material is stored in a newly constructed storage area meeting conforming standards, but the area is becoming overloaded, despite the relatively low hazardous waste generation at WRAMC. The accumulation of hazardous waste in unpermitted amounts could result in the center falling under RCRA Part B regulations by exceeding the 90-day limit for unpermitted storage. The situation has resulted from a recent order to remove large quantities of outdated chemicals and a failure of contractors to pickup the material in a timely manner. WRAMC and Forest Glen generate radioactive and infectious waste. The Health Physics Office handles the storing, use, and disposal of the radioactive materials. There does not appear to be a problem with disposal of these materials. Infectious wastes are stored in a designated infectious waste shed until permitted disposal.

WRAMC is not a major contributor of pollutants to the Chesapeake Bay system. WRAMC was not examined further during Phases II and III of this study.

Recommended actions for WRAMC relate to ensuring use of BMP's for erosion control and compliance with RCRA and TSCA regulations. Recommended actions are summarized in Chapter 5.

4.5.9 Installation 41: Vint Hill Farms Station (VHFS)

4.5.9.1 **General**. VHFS is located in the north-northeast part of Fauquier County, Virginia, approximately 40 miles southwest of Washington, D.C. The installation covers 719 acres and drains to South Run in the north and to Kettle Run in the south. Both of these creeks drain to the Potomac River. The principal mission of VHFS is to serve as an Army field activity engaged in communication intelligence.

4.5.9.2 **Summary of Impact Potential and Recommended Actions**. In Phase I of this study, VHFS was screened in Study Group 2, based on the potential for toxic leachate to migrate from sludge landfills and a discharge lagoon into local receiving waters. The installation assessment methodology was applied to VHFS during Phase III to better define the likely character and extent of VHFS's impact on local receiving waters. As a result of this analysis, VHFS remains in Study Group 2 (poorly defined, likely significant). Table 4.19 summarizes the areas of concern and recommended actions identified for VHFS. Areas of concern include cyanide and metals contamination of South Run downstream of the VHFS STP discharge, elevated cyanide contamination in South Run off-post and downstream of the former EPA/EPIC photographic laboratory discharge/lagoon, and lack of a permit for land disposal of sludge from the STP. South Run eventually enters the Occoquan River system, which serves as a drinking water supply for the area. Despite these concerns, VHFS has promoted a number of activities to minimize potential water quality impacts. These include suspension of a large sandblasting and painting operation and conversion to a self-contained unit, operation of a pretreatment system for photochemical wastewater from EPA/EPIC operations, and preservation of large areas as forested and unimproved lands, which act as buffers to minimize nonpoint source pollution.

Recommended actions for VHFS include:

- Continued monitoring of STP effluent for TSS permit violations to determine possible need for infiltration analysis.
- Perform routine monitoring of cyanide levels in STP and EPA/EPIC pretreatment effluent to determine need for corrective action.
- Perform periodic monitoring at established surface and groundwater sampling locations on and off post to develop trends in observed cyanide contamination and verification that contaminant levels are indeed decreasing, as currently expected.
- Implement and/or continue UST testing program.

Table 4.19 Summary of Areas of Concern and Recommendation for Vint Hill Farms Station

Activity/Pollutants of Concern	Onsite	Offsite/Vicinity	Recommendations	Estimated Cost
STP/chlorine, BOD, TSS	DMR data shows constant CL and TSS violations	VSWCB (1986) monitoring station SOT00144 (South Run) 30% coliform violations, heavy metals (As, Cr, Cu, Zn) in sediments and (Ni) in water column. Benthic population declining; USATHAMA (1986) found cyanides in South Run downstream of STP, leachate migration into South Run observed as heavy iron flocculant, sediment and scum.	Review STP operation to determine continued TSS violations, Implement UV system to eliminate chloride residuals.	<u>Review operations</u>: $50,000
EPA/EPIC photographic laboratory pretreatment-cyanide metals			Perform effluent toxicity sampling of EPIC discharge and review treatment system to determine possible corrective actions.	<u>Pretreatment system study</u>: $40,000
Former lagoon and past photographic lab industrial discharge area/cyanides, silver, heavy metals, phenols, ammonia	Cyanide in tributary to South Run (USATHAMA, 1986)		Perform routine stream sampling down gradient of lagoon area to confirm expectation of decreasing source strength. Possible remedial action if contamination does not decrease.	<u>Monitoring</u>: $30,000 per year
Sludge disposal area and landfill area/heavy metals, POL, organic solvents	USATHAMA onsite groundwater data show decreasing trend in groundwater contaminant levels from these areas		Obtain proper sludge disposal permit.	--
UST-POL	USATHAMA (1986) no evidence of leaking		Implement UST program.	<u>Testing</u>: $400 - $700 per tank

4.5.10 Installation 43: Cameron Station (CAMSTA)

4.5.10.1 General. CAMSTA is located on 180 acres within the city limits of Alexandria, Virginia, and borders mixed commercial and industrial development. The installation is adjacent to Cameron Run which discharges to the tidal Potomac. CAMSTA's primary mission is to provide support for the Commanding General of the Military District of Washington (MDW).

4.5.10.2 Summary of Impact Potential and Recommended Actions. The screening data for CAMSTA are summarized in Tetra Tech (1986). Based on the screening criteria, CAMSTA was screened in Study Group 3, having a poorly defined but likely insignificant impact potential on ecological resources of the Chesapeake Bay (see Table 4.16). This judgement is based on the following observations.

a. CAMSTA has off-site disposal of solid waste and domestic and industrial wastewater, and has effective erosion control measures consisting of a concrete flume, riprap, and sediment collecting ponds. CAMSTA has an active wildlife and habitat program utilizing the base lake, Lake Cameron, as a birdwatching area by many local residents.

b. Staff personnel stated that the onsite warehouses are distribution points for supplies to regional MDW sites. A potential exists for accidental spills and leaks of hazardous materials (i.e. solvents, degreasers, cleaning fluids) during handling and distributing.

c. In 1984 a USAEHA pesticide monitoring survey report found soil samples exceeding permitted levels of DDT and chlordane. The study also found elevated levels of PCB. Because of the persistent nature of chlorinated hydrocarbons in the environment, the presence of these compounds can be indicative of past, as well as current usage.

d. During a visit of the on-site storage yard, PCB labelled and inspected transformers were observed being stored on wooden pallets. There were no spill containment measures evident.

CAMSTA contributes relatively minor urban pollutant loads to the area and was not examined further in Phase III of this study. Recommended actions for CAMSTA include ensuring full compliance with RCRA and TSCA regulations and implementing updated SPCC and UST programs. Recommended actions are summarized in Chapter 5.

4.5.11 Installation 44: Fort McNair

4.5.11.1 General. Fort Leslie J. McNair is located within the District of Columbia on Greenleaf Point in southwestern Washington, D.C. The Anacostia River forms the southern boundary of the installation and Washington Channel of the Potomac River forms the western border. Fort McNair is a national historic site, and activities on this park-like

installation are closely scrutinized by the public. Fort McNair is one of three major posts under the command of the Military District of Washington (MDW), the other two being Fort Myer and Cameron Station. The primary mission of Fort McNair is to prepare and maintain plans for the rescue, evacuation, and security of the President and to provide protection for the seat of Government. Fort McNair is also responsible for the Armed Forces' participation in ceremonies conducted in the Nation's Capital.

4.5.11.2 Summary of Impact Potential and Recommended Actions. The screening criteria data for Fort McNair are summarized in Tetra Tech (1986). Based on this information, Fort McNair was screened in Study Group 4, having an insignificant impact potential on water quality and ecological resources of Chesapeake Bay (see Table 4.16). The installation was not addressed in Phase III of this study.

One possible recommendation to enhance future environmental compatibility would be the installation of an interceptor between the PX gas station (Building 43) and the nearest storm sewer inlet on Fifth Avenue. This would help contain potential spills from refueling operations and prevent them from reaching the waters of the Anacostia River. Recommended actions for Fort McNair are summarized in Chapter 5.

4.5.12 Installation 45: Fort Myer (FYM)

4.5.12.1 General. FYM is located on 256 acres in Arlington County, VA, directly across the Potomac River from Washington, D.C. The primary mission of FYM, one of the installations of the Military District of Washington (MDW), is providing housing for senior general officers and administrative support for various tenant activities. Arlington National Cemetery borders FYM to the east.

4.5.12.2 Summary of Impact Potential and Recommended Actions. The screening data for FYM are summarized in Tetra Tech (1986). Based on the screening criteria, FYM was screened in Study Group 4, having an insignificant impact potential on water quality and ecological resources of Chesapeake Bay (see Table 4.16). Major considerations for this judgement include the following:

a. FYM has an old system of sanitary sewers (70 years) and has had problems with inflow and there may be a problem with infiltration. Also, there is some combination of stormwater and sanitary sewers. There is presently no detectable problems with the system, partly due to the low groundwater table. Arlington County Sewer District treats all FYM sanitary sewer discharges.

b. FYM has limited industrial wastewater discharges. The pesticide program is administered from Cameron Station and all pesticides are stored there.

c. PCB's have been detected in an abandoned landfill in minor amounts. The site is being cleaned up. There are no warranted confirmation sites at FYM.

FYM is characterized as an administrative and housing facility with little industrial or hazardous waste activity. Pollutant contributions are limited to the general urban environment and, therefore, the installation was not examined further during Phase III of this study. Recommended actions for Fort Myer include ensuring the integrity of the sanitary and storm sewer system, and are summarized in Chapter 5.

4.5.13 Installation 48: Fort Belvoir

4.5.13.1 General. Fort Belvoir covers approximately 9200 acres and is located 18 miles southwest of Washington D.C. on the western shore of the Potomac River in Fairfax County, Virginia. The site drains into the Potomac via Dogue, Accotink, and Pohick Creeks. Fort Belvoir is the home of the United States Army Engineer School (USAES) and a host of other U.S. Armed Forces units. The USAES is responsible for providing a progressive program of both resident and non-resident training and education in the functions, tactics, and techniques of military engineering.

4.5.13.2 Summary of Impact Potential and Recommended Actions. In Phase I of this study, Fort Belvoir was screened in Study Group 2, based on a recent history of chronic fuel spills, a poorly characterized and unmonitored storm sewer system serving several industrial activities, potential sources of contaminants to Accotink Creek from landfill leachate and storm runoff, and a past history of erosion and sedimentation problems on the installation. The installation assessment methodology was applied to Fort Belvoir during Phase III to better define the likely character and extent of Fort Belvoir's impact on local receiving waters. As a result of this analysis, Fort Belvoir remains in Study Group 2. Table 4.20 summarizes the areas of concern and recommended actions identified for Fort Belvoir. As shown in this table, areas of concern include contaminants leaching into Accotink Creek from two inactive landfills and from a coal storage area, possible existence of minor industrial discharges to the storm sewer system and lack of a stormwater management plan including a monitoring program, and heavy sedimentation in the local creeks and embayments. No adequate data exist in the local streams or embayments to verify the existence or nonexistence of contaminants from Fort Belvoir's operations, or to differentiate the installation's contributions from the potentially significant upstream (Fairfax County) and surrounding influences. Despite these concerns, Fort Belvoir has implemented several progressive and environmentally beneficial programs over the last several years. For example, the recent history of chronic fuel spills has been reversed with no major fuel spills occurring since 1985. Fort Belvoir has instituted an UST testing program with over 50% of the tanks having been tested. Fort Belvoir's land management plan is also progressive and has included restoration of badly eroded areas, identification and protection of environmentally sensitive areas (wetland buffers, steep slopes, etc.), and establishment of the 700 acre Accotink Wildlife Sanctuary. Recommended actions for Fort Belvoir include:

Table 4.20 Summary of Areas of Concern and Recommendations for Fort Belvoir

Area and Pollutants of Concern	Onsite	Offsite/Vicinity	Recommendations	Estimated Cost
Fuel spills/leaking underground tanks, petroleum hydrocarbons solvents, and antifreeze	1985-12,400 gals of fuel oil spilled, 1 spill of 6000 gal resulted in the death of 3-6000 fish in Dogue Creek. An underground storage tank spill has contaminated adjacent soil and may migrate to surface waters.	Long-term sublethal stress to aquatic life and degraded spawning habitats possible if elevated petroleum concentrations exist. No vicinity data exist to verify pollutants of concern.	Review SPCC plan for implementation aspects, update as necessary. Continue LUST program and clean up/remedial actions.	<u>Plan review update</u>: $50,000 <u>UST testing</u>: $400-$700 per tank
Landfill leachate migration BOD, COD, Fe, and unknown chemicals	Poe Road Landfill leaching 20,000 gpd to Accotink Creek (BOD/COD/TSS). Accotink Landfill potentially leaching elevated BOD/COD/Fe/unknowns in area adjacent to wetlands.	WES (1978) monitoring of conventionals did not indicate a problem from Poe Road Landfill. Storet data and VSWCB (1986) indicate eutrophic conditions in Pohick Bay at mouth of Accotink Creek and levels of Ni, Cu, As, Pb, and Cr in the sediment are elevated. Possible long-term sublethal stress to aquatic life and degraded habitats due to eutrophic conditions and priority pollutants.	Monitor Accotink Stream Quality/ Sediments	<u>Monitoring</u>: $50,000 (one time event) <u>Leachate control</u>: $250,000 - $400,000 per landfill
Erosion/Sedimentation TSS/toxic pollutants/BOD/COD	Extensive post-war development and training activities has increased erosion/sedimentation due to removal of protective ground cover. Recently implemented measures, however have decreased amount of erosion and sedimentation.	SAV beds appear to be increasing in area (WASHCOG, 1985).(?) Development of Accotink Wildlife Area increased biological productivity of area. Upstream development significantly contributing to total pollutant/sediment loads.	Implement Best Management Practices. Monitor contractors, and training activities. Update Natural Resources Plan.	<u>Update plan</u>: $40,000 <u>Monitor BMP's</u>: $30,000 - $50,000 per year
Stormwater Runoff; GSA Coal Storage	Possible industrial discharges to surface water and GSA discharge could result in elevated pH and heavy metal concentrations.	Storet data for Accotink Creek (downstream of Fort Belvoir) indicates elevated levels of Ni, Cu, As, Pb, and Cu in sediments. Possible long-term sublethal stress to aquatic life and degraded habitat.	Monitor storm drains and locate all industrial discharges and route to sanitary system. Monitor stream downstream of coal pile. Implement further improvements to collection system.	<u>Monitoring</u>: First year - $100,000 - $200,000 Followup years - $50,000/year <u>Stormdrain study</u>: $70,000

- Periodic review and update of the SPCC plan to minimize future POL spills;

- Continue and complete the UST testing program;

- Design and implement a stormwater management plan including a periodic monitoring program for the stormwater drainage system to identify and treat, if necessary, any industrial discharges;

- Review and update, if necessary, the Natural Resources Plan to ensure implementation of best management practices for control of erosion and sedimentation; and

- Design and implement a periodic monitoring program for surface water and sediment quality in the creeks and embayments on and around Fort Belvoir. The program should be designed to isolate Fort Belvoir's contribution's from the potentially significant upstream and local pollutant contributions.

4.5.14 Installation 52: Andrews Air Force Base (Andrews AFB)

4.5.14.1 **General.** Andrews AFB is located near Camp Springs, Maryland, in the center of Prince George's County about 10 miles southeast of Washington, D.C. The site occupied by Andrews AFB consists of a slightly rolling plateau. The western portion of the base drains into Henson Creek, Tinker's Creek, and Piscataway Creek all of which flow into the Potomac River. The eastern part of the base drains into Cabin Branch and Charles Branch which flow into the Patuxent River. The mission of Andrews AFB is to provide support to Headquarters U.S. Air Force and other agencies in the National Capital Region and to provide safe and reliable airlift for the President, Vice President, Cabinet Members, and other high ranking civilian and military dignitaries.

4.5.14.2 **Summary of Impact Potential and Recommended Actions.** In Phase I of this study, Andrews AFB was screened in Study Group 2, based on the potential for large scale fuel spills into the local drainage system, stormwater runoff potential and stream bank erosion, questionable hazardous waste handling and storage practices, and the existence of several inactive waste disposal sites with potential for leachate migration into local streams. The installation assessment methodology was applied to Andrews AFB during Phase II as a test to better define the likely character and extent of Andrews AFB's impact on local receiving waters. As a result of this analysis, Andrews AFB remains in Study Group 2. Table 4.21 summarizes the areas of concern and recommended actions for Andrews AFB. As shown in this table, areas of concern include the violation of oil and grease permit limits for several oil/water separators for the large stormwater drainage system, observed stressed water quality conditions in the streams draining the installation, observed stream bank erosion during heavy storm events and construction, and potential release of toxics into surface waters from several inactive hazardous waste disposal and past spill sites. Generally, there are inadequate data on-site and downstream of Andrews AFB to determine

Table 4.21 Summary of Areas of Concern and Recommended Actions for Andrews AFB

ACTIVITY/POLLUTANTS OF CONCERN	ONSITE	OFFSITE/VICINITY	RECOMMENDATIONS	EST. COST
Fuel/oils in stormwater runoff or spills	Andrews AFB stream monitoring data (dry weather) show highest oil and grease concentration = 2.9 μg/1 and most values under 1 μg/1.	MDOEP station P150033 benthic data indicate poor quality water	Implement series of recommendations in 1982 SPCC plan for upgrades and additions to oil/water separators. Conduct wet weather stream monitoring	<u>Monitoring</u>: $50,000 - $100,000 <u>Upgrades to O/W Separators</u>: $20,000 - $50,000 per separator
Local stream bank erosion during storm events/construction	Several drainage ditches severely eroded at time of installation visit.	Garrison (1986) reports local streams have high TSS from agricultural and urban runoff from regional land use	Implement NCPC recommended revisions to Stormwater Management Plan, i.e., BMP's for soil and stream bank erosion control	<u>Management</u>: $25,000 - $40,000 per year (labor) <u>Controls</u>: Costs unknown (site dependent)
Toxics from abandoned dumpsites, spill sites	Andrews AFB stream monitoring data show elevated levels of Hg, Zn and Fe	MDOEP station P150033 benthic data indicate poor quality water	Implement recommendations from findings of ongoing confirmation studies	Costs unknown

with confidence the impact level of the installation's activities on local water quality. Beneficial aspects of Andrews AFB operations include disconnection of several sewage treatment plants, and recent improvements to POL management, SPCC plans (i.e., no major fuel spills have occurred in last 3 years), and hazardous materials management. Recommended actions for Andrews AFB include:

- Implement necessary upgrades or additions to oil/water separators and implement updated SPCC plans;
- Conduct wet weather monitoring of storm drainage system to determine adequacy of controls;
- Update stormwater management plan to include best management practices for erosion control;
- Review results of Phase II IRP confirmation studies for the 11 inactive waste disposal sites, to determine the need, if any, for remedial actions; and
- Implement an UST testing program.

4.5.15 Installation 54: Bolling Air Force Base (Bolling AFB)

4.5.15.1 General. Bolling AFB is located in southeastern Washington, D.C. at the confluence of the Potomac and Anacostia Rivers. The Potomac River forms the western border of the base. In 1962, all fixed wing aircraft operations were transferred to nearby Andrews AFB. The base is currently used as an administrative and personnel support center for Air Force activities in the National Capital Region.

4.5.15.2 Summary of Impact Potential and Recommended Actions. The screening criteria data for Bolling AFB are summarized in Tetra Tech (1986). Based on this information, the installation was screened in Study Group 3, having a poorly defined but likely insignificant impact potential (see also Table 4.16). This determination is based on the following observations:

a. There are three potentially contaminated sites at Bolling AFB which have been identified for confirmation studies in the Installation Restoration Program Records Search (Engineering-Science, 1985). These sites include an abandoned landfill within 500 ft of the Potomac River, a fire protection training area also within 500 ft of the Potomac, and a fuel spill/leak area at the base heating plant.

b. Large quantities of stormwater runoff occur during rainfall events due to the highly developed nature of the base. Some of the storm sewer trunk lines are clogged with debris which hampers the efficiency of stormwater removal from the base. However, no

erosion problems due to stormwater runoff were noticed during the installation visit.

c. Bolling AFB has an underground storage capacity of 316,000 gallons for fuel and petroleum products. This presents the potential for environmental contamination due to leaking underground tanks and/or refueling spills.

d. Bolling AFB has a tightly managed pesticide program which greatly reduces the potential for environmental damage from handling and use of the chemicals.

e. Only about 120 kg of hazardous wastes are generated at the installation each month. The waste is stored temporarily at various waste accumulation points until removal to the Brandywine DPDO facility.

Since Bolling AFB is not apparently a major contributor of pollutants to the aquatic environment of Chesapeake Bay, it was not examined further in Phase III of this study. Recommended actions for Bolling AFB include ensuring use of BMP's for stormwater runoff control, implementation of an UST testing program, implementation of an updated SPCC plan, and completion of confirmation studies for the three inactive disposal sites. Recommended actions are summarized in Chapter 5.

4.5.16 Installation 78: Brandywine Defense Reutilization and Marketing Office (DRMO)

4.5.16.1 General. Brandywine DRMO is located in Prince George's County, Maryland, approximately 15 miles south of Washington, D.C. There is no direct drainage to the Potomac River. The primary mission of the DRMO is the processing of used, excess, and dated DoD property by resale, reuse, or disposal.

4.5.16.2 Summary of Impact Potential and Recommended Actions. The screening data for the DRMO are presented in Tetra Tech (1986). Based on the screening criteria, the DRMO was screened in Study Group 3, having a poorly defined but likely insignificant impact potential on water quality and ecological resources of Chesapeake Bay (see Table 4.16). Major considerations for this judgement include the following:

a. The DRMO has an on-site septic system consisting of solid pumping and liquid ground leaching. The system may be the source of high coliform counts in the installation's well water. (Note: improvements to the septic system were recently completed and effluent is expected to meet NPDES limits).

b. A storage facility for all toxic, flammable, and hazardous material is to be built in 1988. Presently, storage is in non-conforming areas. Indoor storage can result in sewer system contamination. Outdoor storage can result in stormwater runoff contamination.

c. The DRMO is a warranted confirmation site because of inadequate past storage and containment of PCB transformers and liquid material, which resulted in leaks and spills (the Air Force plans to remove the PCB contaminated soil). There is no hazardous response team or plan. Although an interservice agreement exists with Andrews Air Force Base, previous needs were not satisfied. Current negotiations are under way between Andrews and the Brandywine Fire Department.

d. Incoming vehicles destined for storage do not have their transmission and motor oil tanks purged. This may result in leaks and spills occurring in the gravel yard.

e. There is no receiving water on the installation. During periods of high rainfall, the backyard floods but there are no erosion or sediment problems on the installation.

The DRMO has no direct drainage to a tributary of the Chesapeake Bay and, therefore, was not examined further during Phase III of this study. Recommended actions for Brandywine DRMO include implementation of plans for construction of a conforming hazardous materials storage facility, and provision of adequate SPCC and hazardous materials response plans. (Note: a 1986 fire destroyed the main operational structure at Brandywine. DLA closed the DRMO operation.) Recommended actions are summarized in Chapter 5.

4.5.17 <u>**Installation 79: Harry Diamond Labs - Woodbridge Research Facility (WRF)**</u>

4.5.17.1 <u>**General**</u>. WRF is located on a neck of Federally owned land consisting of 579 acres south of River Bend Estates in Woodbridge, VA, in Prince William County. The installation is on the west side of the Potomac River between Occoquan Bay and Belmont Bay and is approximately 24 miles southwest of Washington, D.C. As a satellite installation of Harry Diamond Laboratories (HDL), WRF's mission is to conduct vulnerability assessments of new and fielded tactical systems and to determine the effects of electromagnetic pulses (EMP) created by nuclear weapons on electronic equipment.

4.5.17.2 <u>**Summary of Impact Potential and Recommended Actions**</u>. WRF screening data are summarized in Tetra Tech (1986). Based on this information, WRF was screened in Study Group 4, having an insignificant impact potential on the Chesapeake Bay and associated ecological resources (see Table 4.16). This judgement is based on the following observations:

a. Due to effective soil conservation, wetlands management, and shoreline erosion control programs, WRF is not degrading the topography of the land or surface water quality . There are two U.S. Fish and Wildlife Refuges located nearby and the Marumasco

Creek is a designated tidal wetland by the Prince William County Tidal Marsh Inventory. Based on periodic surveys of WRF fish and wildlife resources by HDL, Fish and Wildlife Services, and State of Virginia personnel, no adverse impacts are reported on the biota. The bald eagle has been observed repeatedly on WRF and nests at nearby Mason Neck National Wildlife Refuge.

b. EMP research conducted at WRF produces pulse durations of 800 nanoseconds. EMP field levels at the boundary fence line which have been found by measurement to be less than 2 KV/m at 1.5m in height. This is less voltage than necessary to upset a pacemaker. There are currently no standards established for safe levels of exposure to EMP.

c. A landfill was discovered to contain several transformers and capacitors containing PCB's. Subsequent soil samples revealed contaminated soils within the immediate area of the landfill. The contents of the landfill were excavated and disposed at an off-site disposal area.

Due to the absence of major pollutant generation on-site, WRF did not receive further detailed examination during Phase III of this study. There are no recommended actions for WRF.

4.5.18 Installation 84: U.S. Naval Observatory (NOBSY)

4.5.18.1 General. The NOBSY covers 72 acres and is located in the heart of Northwest Washington, D.C. The runoff from this site drains via the city storm sewer system into nearby Rock Creek, and eventually to the Potomac River. NOBSY functions include scientific research, administrative mapping, and the residence of the Vice President of the United States.

4.5.18.2 Summary of Impact Potential and Recommended Actions. The screening data for NOBSY are summarized in Tetra Tech (1986). Based on this information, plus results of the installation visit, NOBSY was screened in Study Group 4, as shown in Table 4.16. It is clear that NOBSY has an insignificant impact potential to local surface waters. In fact, the installation is extremely well maintained and promotes environmental enhancement of the undeveloped (non-impervious) area on the installation, which accounts for about 80% of the land surface. This installation did not receive further detailed analysis in Phase III of the study. There are no recommended actions for NOSBY.

4.5.19 Installation 85: Naval Communications Unit, Washington (NCU)

4.5.19.1 General. The NCU covers approximately 250 acres and is located at Cheltenham, Maryland approximately 15 miles southeast of Washington, D.C. and about 2 miles south of Andrews Air Force Base. The NCU drains into Piscataway Creek, a tributary of the Potomac River. The NCU mission is to

manage, operate and maintain communications equipment and facilities for the Naval Telecommunications Command.

4.5.19.2 **Summary of Impact Potential and Recommended Actions.** The preliminary screening data for NCU are summarized in Tetra Tech (1986). A review of this information clearly indicates that NCU has an insignificant impact potential on surface water quality and ecological resources, therefore, NCU was screened in Study Group 4 (Table 4.16). This installation was not addressed further in the Phase III detailed assessment activities. Recommendations to enhance future environmental compatibility include implementation of the natural resources/wildlife management plan recently developed in FY87 by the U.S. Fish and Wildlife Service for NCU. Recommended actions are summarized in Chapter 5.

4.6 REGION 5: POTOMAC RIVER TRANSITION ZONE

4.6.1 Tributary/Regional Description

4.6.1.1 Environmental Setting. The transition zone of the Potomac estuary lies entirely within the Atlantic Coastal Plain. The Potomac estuary at this point experiences a transition from freshwater (no salinity) on the north to estuarine (higher salinity) on the south. Because it is a highly variable environment, the diversity of aquatic life (but not the productivity) is relatively low. In spring, with higher river flows, the waters are more riverine (less than 0.5 ppt salinity), but at the end of a dry summer the waters may be more estuarine (0.5-5.0 ppt). The mean tidal range is between 1.8 and 1.3 feet at various locations within the transition zone.

The Potomac River in this transition zone is characterized by shallow sandy flats on the west side and commercial shipping near the east side, where channel depths reach about 25 feet (7.6 m). Sediments are generally sandy in the shallower areas and muddy in channels and quiet waters.

Water quality in this reach of the Potomac has received unusually comprehensive characterization since the mid-1960's in studies performed by EPA, the State of Maryland, and the U.S. Geological Survey. Ongoing monitoring continues, but with lesser intensity, as part of EPA's Chesapeake Bay Program. The extensive analyses of water quality trends performed by the EPA Chesapeake Bay Program indicate that the reach has enriched nutrient conditions, recurrent phytoplankton bloom conditions, and some metals contamination.

Water quality in the transition zone has suffered from the influence of generally poor water quality in the upstream metropolitan District of Columbia. During a significant rainfall event, pollutants can be rapidly transported downstream to the transition zone. Historically, the transition zone has experienced the invasion of water chestnut, water milfoil and blue green algae. Although the Potomac River lost abundant SAV during the Bay-wide decline of the 1970's and 1980's, relatively healthy populations still

exist in the riverine-estuarine transition zone. Currently, a potential invasion by another exotic water plant, Hydrilla, is a concern.

Next to the head of the Bay region, the Potomac Transition Zone is considered the most important spawning and nursery area for striped bass in the Chesapeake Bay system. There have been significant commercial fisheries in the area, primarily for anadromous species, but also for the blue crab.

The area is also known for aggregations of the endangered bald eagle, which fish and nest along the shore. The area is also used by overwintering waterfowl, including Canada goose, tundra swan, canvasback, goldeneye, scaup, mallard and black ducks.

The Naval Ordnance Station at Indian Head, Maryland and the Marine Corps base at Quantico, Virginia are located at the upper boundary of the transition zone of the Potomac estuary, where the upstream influence of salinity is just evident (see Figure 4.9).

4.6.1.2 Vicinity Pollutant Loads

Vicinity Point Sources. There are seven STPs currently discharging to the Potomac transition zone as shown in Figure 4.6 and Table 4.13. These STPs have a combined average discharge flow of 3.8 MGD.

Table 4.14 presents estimates of metals from point sources (STPs) by county into the Potomac estuary (EPA, 1982). There are no known major industrial point sources for metals or toxic organics in the Potomac estuary.

Vicinity Nonpoint Sources. Upland areas represent the greatest source of conventional pollutants, particularly BOD, sediments, and nutrients, to the Potomac estuary. Nonpoint sources to the tidal Potomac can be separated into three major categories: 1) upstream loadings at the Fall Line at Chain Bridge; 2) combined sewer overflows (CSO) from urban areas in the District of Columbia and Alexandria, Virginia; and 3) local (below the Fall Line) tributaries to the Potomac Estuary. Table 4.15 presents estimates of upstream pollutant loadings at Chain Bridge over the years 1983 to 1984 (WASHCOG, 1985). Similar estimates for CSOs are not available; however, in 1983 an estimated 2.9 billion gallons (8 MGD) of untreated overflow were discharged from the District of Columbia's system (O'Brien and Gere, 1984). Similarly, no loadings estimates are available for the local tributaries below the Fall Line. These areas collectively make up about 12 percent of the total Potomac drainage basin area. Since the land use in the lower estuary is similar to that above the Fall Line (primarily rural and agricultural), a rough estimate of nonpoint source pollutant loadings is possible based on the ratio of surface area between a local drainage basin and the entire basin.

Nonpoint sources of metals to the Potomac transition zone include atmospheric deposition, urban runoff, and upstream loadings at the Fall Line. Table 4.14 presents estimates of metals loadings from nonpoint sources (above Fall Line) to the Potomac estuary (EPA, 1982). There

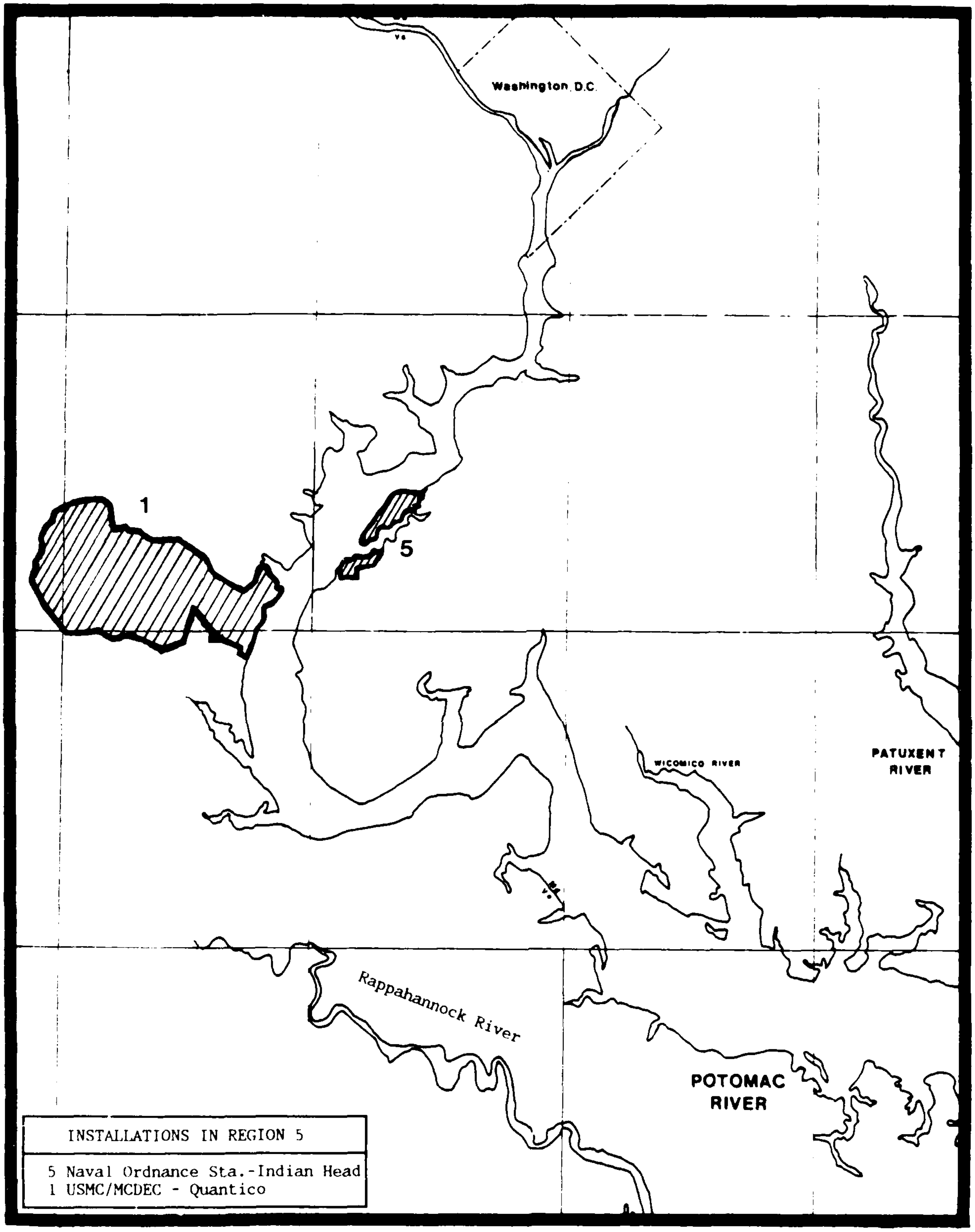


Figure 4.9 Region 5 - Potomac River Transition Zone

currently are no similar estimates of nonpoint source loadings of toxics to the Potomac estuary.

4.6.1.3 Relative Comparison to DoD Installation Pollutant Loads.

Point Sources. Both NOS Indian Head and MCDEC Quantico, located in the Potomac River Transition Zone, operate sewage treatment systems. At NOS Indian Head, there are 48 industrial wastewater and three sanitary wastewater discharges to the Potomac River, Mattawoman Creek, and Chicamuxen Creek. The sanitary wastewater treatment systems have been recently upgraded and are in compliance with NPDES permit limits. The 48 industrial wastewater discharges serve a wide variety of activities at NOS including ordnance and propellant manufacturing, paint spraying, product washwater, tooling and machine shops, boiler blowdown, and building floor drains. Contaminants found or known to exist in the wastewater discharged from the process operations at NOS include suspended solids, BOD, oil and grease, nitrate esters (RNO_3), amines (RNH_2), TNT, methylcel, and toxics such as cyanide, silver, mercury, lead, zinc, 1,1,1-trichloroethane and methylene chloride. Wastewater treatment consists primarily of solids settling and oil separation, as well as neutralization of acidic wastewater from the Moser Plant and limited biological treatment of TNT pink water from the explosives steam-out facility located on Stump Neck.

The NPDES permit for the industrial wastewater system is currently undergoing revision by EPA and will require extensive consolidation and expansion of treatment facilities to meet the expected stricter permit limits. The current NPDES permit tracks only TSS, pH, and oil and grease. Monitoring data on toxic constituents in the industrial effluents is not routinely performed, nor required by permit. It is expected that the final revised permit will include limits and monitoring requirements for metals and toxics in addition to the conventional parameters. NOS is in the process of characterizing the industrial wastewater effluents and has begun preliminary studies to design a new industrial wastewater treatment system. Current plans indicate possible construction to begin in fiscal year 1988. The revised NPDES permits will also require extensive flow monitoring and sampling and analysis of both conventional and nonconventional pollutants.

There are two STPs operating at MCDEC. The Mainside STP operates close to its design capacity of 2 MGD, and has had tertiary nitrification and clarification since 1977. The effluent from the Mainside STP discharges to the Potomac River. The second STP is a 0.09 MGD tertiary modular plant located at Camp Upshur. This plant generally operates from May to September and discharges into Cedar Run, a tributary of Occoquan Creek. Past permit violations for both STPs have included excessive total suspended solids, however, in general both plants appear to be properly operated and maintained.

The NOS and MCDEC STP discharges are located in the Transition Zone near the boundary between this zone and the Tidal Freshwater Zone of the Potomac estuary (see Figure 4.7). These discharges contribute less than one percent of the total conventional pollutant loadings from point sources in the Tidal

Freshwater Zone. In comparison these discharges contribute approximately 25 percent of the conventional point source pollutants loadings in the Transition Zone. However, the total Transition Zone loadings account for only two to six percent of the total point source loadings to the Potomac Estuary.

Although it was not possible to estimate the metals or toxics loading from MCDEC discharges, it is expected that these are similarly minor compared to the total metals loadings from vicinity point sources to the Potomac Estuary. Due to lack of information on industrial pollutants and conventional pollutants in the industrial discharges at NOS, a comparative analysis for NOS cannot be made. A large number of industrial waste discharges exist at NOS, several of which are known to contain nutrients, metals, and toxic constituents. Many of these discharge directly to Mattawoman Creek, an important tidal wetland area and fish spawning and nursery habitat.

Nonpoint Sources. On a regional scale, NOS and MCDEC contribute a relatively insignificant loading of nonpoint source pollutants to the Potomac estuary compared to the surrounding contributions. Based on land surface area, for example these installations represent less than one percent of the total Potomac River drainage area (including above and below the Fall Line). Despite the large surface area of MCDEC, the contributions of nonpoint source pollutants to the Potomac estuary are relatively insignificant, partially due to the fact that the majority of MCDEC (80 percent) is forested land, and also because none of the land area is used for agricultural purposes. Erosion and sedimentation have been identified as a problem at MCDEC by base personnel, but most of the sediments appear to be trapped within the ponds and reservoirs on the base. The only apparent nonpoint source concern at Indian Head involves the severe erosion rates along the Potomac River shoreline of Indian Head. The Corps of Engineers has estimated that erosion along Indian Head contributes approximately 0.26% of the sediment load to the Chesapeake Bay on a Bay-wide basis (U.S. Army, 1985).

4.6.1.4 Summary of DoD Impacts on the Potomac River Transition Zone. The locations of the two DoD installations in this region are shown in Figure 4.10. In Phase I, both NOS Indian Head and MCDEC were estimated to have a likely significant potential for adverse water quality impacts by nature of their proximity to the Bay and the activities on the installations. These installations were evaluated in greater detail during Phase II of this study.

Table 4.22 presents the results of the final screening of NOS Indian Head and MCDEC Quantico. NOS Indian Head was screened in Study Group 1 (Significant Impact Potential) primarily due to the existence of industrial pollutants and high suspended solids and BOD/nutrient levels in the industrial discharges, as well as the existence of metals deposits in wetlands adjacent to Mattawoman Creek. MCDEC was screened in Study Group 2 (poorly defined, likely significant impact potential) based on concerns related to possible toxics in the storm drainage system, high erosion and

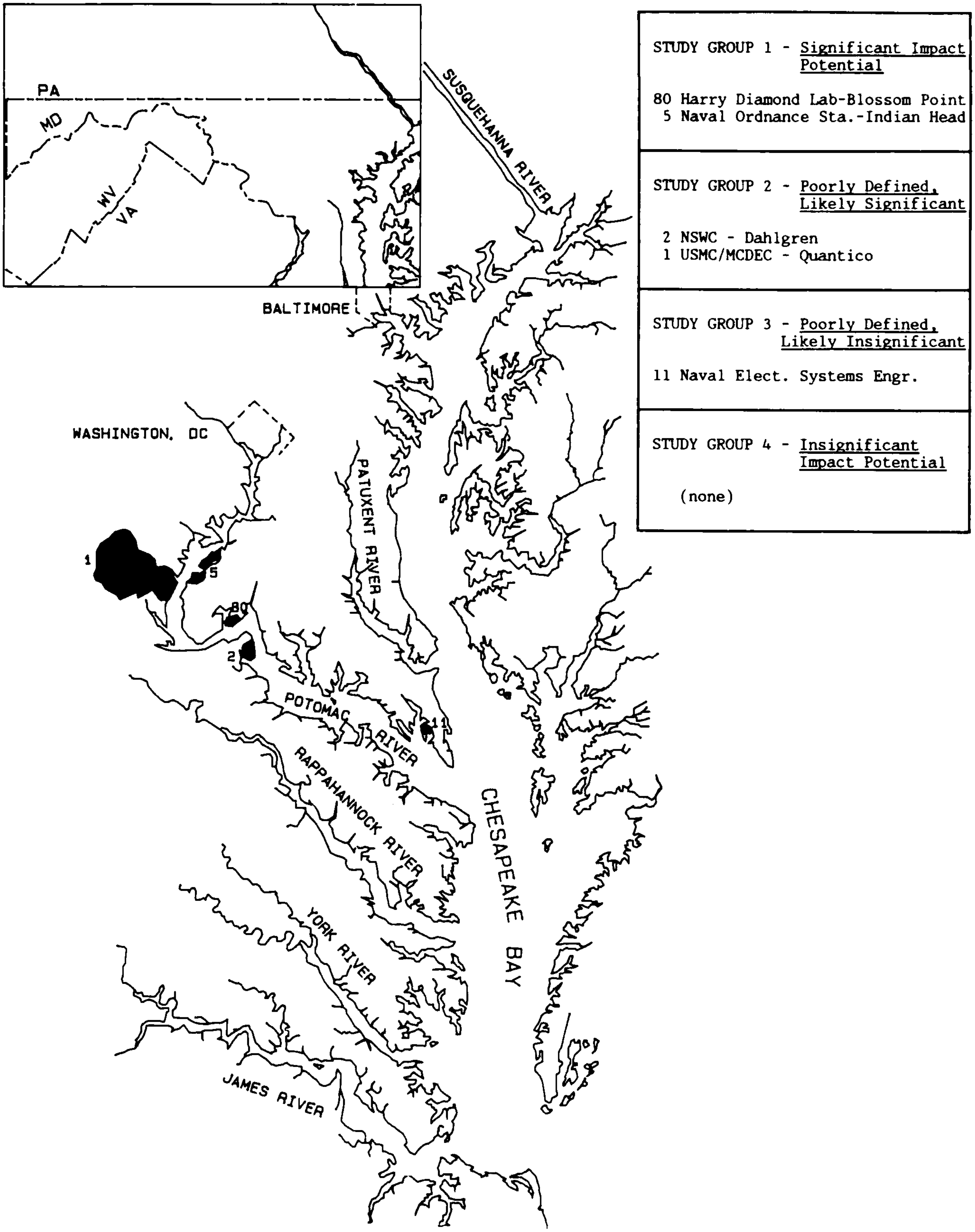


Figure 4.10 Location of DoD Installations in the Potomac River Transition and Saline Zones and Summary of Installation Impact Potential.

T le 4.22 Summary of Final Screening for Installations in the Potomac River Transition Zone

ON-SITE SCREENING CRITERIA (ON-SITE IMPACT POTENTIAL)

ID	Branch	Installation Name	NON-POINT SOURCES: 1. Erosion/Sedimentation	2. Impervious Area Runoff	3. Combined Storm Drains	4. Shoreline Erosion	POINT SOURCES: 5. Sewage Treatment	6. Industrial Waste Treat	7. Intermitt Sewage Treat	HAZARDOUS/TOXIC MATERIALS: 8. Refueling Operations	9. Munitions Operations	10. Chemical Operations	11. Pesticides	12. Vehicle Maintenance
1	NAVY	USMC - Quantico	-	-	Θ	·	+	·	·	⊕	·	·	·	+
5	NAVY	Naval Ordnance Sta.	·	·	Θ	Θ	+	-	·	·	Θ	·	·	·
Score Totals		·	1	1	0	1	0	1	2	1	1	2	2	1
		+	0	0	0	0	2	0	0	0	0	0	0	1
		⊕	0	0	0	0	0	0	0	1	0	0	0	0
		-	1	1	0	0	0	1	0	0	0	0	0	0
		Θ	0	0	2	1	0	0	0	0	1	0	0	0

ID	Branch	Installation Name	HAZARDOUS/TOXIC MATERIALS: 13. Ship Maintenance	14. Solid Waste Disposal	15. Hazardous Waste	16. SPCC Status	17. Abandoned Sites	18. LUST Status	ENVIRONMENTAL PROGRAMS: 19. Forestry Mgmt. Plan	20. Wildlife Mgmt. Plan	21. Soil Conservation Plan	22. Stormwater Mgmt. Plan	23. Wetlands Mgmt. Plan	24. Shoreline Erosion Plan
1	NAVY	USMC - Quantico	·	⊕	-	⊕	Θ	-	⊕	+	-	-	-	·
5	NAVY	Naval Ordnance Sta.	·	·	+	+	Θ	·	+	+	·	·	+	-
Score Totals		·	2	1	0	0	0	1	0	0	1	1	0	1
		+	0	0	1	1	0	0	1	2	0	0	1	0
		⊕	0	1	0	1	0	0	1	0	0	0	0	0
		-	0	0	1	0	0	1	0	0	1	1	1	1
		Θ	0	0	0	0	2	0	0	0	0	0	0	0

VICINITY SCREENING CRITERIA — RELATIONSHIP TO LOCAL ENVIRONMENT

ID	Branch	Installation Name	25. Shellfish Areas	26. SAV Areas	27. Fish Spawning Areas	28. Wetlands Areas	29. Waterfowl Nesting	30. Endangered Species	31. Relative Local Impact
1	NAVY	USMC - Quantico	·	-	-	-	⊕	⊕	+
5	NAVY	Naval Ordnance Sta.	·	-	-	-	·	·	Θ
Score Totals		·	2	0	0	0	1	1	0
		+	0	0	0	0	0	0	1
		⊕	0	0	0	0	1	1	0
		-	0	2	2	2	0	0	0
		Θ	0	0	0	0	0	0	1

STUDY GROUP — IMPACT POTENTIAL

ID	Branch	Installation Name	1. Significant	2. Poorly Defined, Sig.	3. Poorly Defined, Insig.	4. Insignificant
1	NAVY	USMC - Quantico		X		
5	NAVY	Naval Ordnance Sta.	X			
Total Number of Installations per Study Group			1	1	0	0

KEY: Impact Category 1: { Θ Significant Impact Potential (Adverse)
⊕ Significant Impact Potential (Beneficial)

Impact Category 2: { - Unknown or Poorly Defined Impacts (Adverse)
\+ Unknown or Poorly Defined Impacts (Beneficial)

Impact Category 3: · Insignificant Impact Potential (Adverse or Beneficial)

sedimentation rates on the installation, and limited field observations indicating, on a preliminary basis, the migration of leachate into nearby surface waters from inactive landfills. In general, there is a lack of adequate data to characterize the levels of impact and sources of contamination from these installations.

Despite these concerns, the region of influence of these installations in the Potomac River Transition Zone is probably limited to the Figure 4.10 Location of DoD Installations in the Potomac River Transition and Saline Zones and Summary of Installation Impact Potential immediate vicinity of each installation, due partially to the dilution capacity of the Potomac River. Environmentally beneficial activities at MCDEC have included upgrading the sewage treatment plant to AWT with nitrification, construction of a modern fuel storage system and elimination of old spill-prone fuel storage areas, construction of a new hazardous waste storage facility and a modern sanitary landfill with a leachate collection/treatment/monitoring system, and implementation of a comprehensive natural resources and land management plan. Similarly at NOS, beneficial programs have included significant sanitary sewage system upgrades, construction of a conforming hazardous waste storage facility, improvement to oil and chemical spill control and containment systems, and implementation of a natural resources management plan which includes soil conservation practices, forestry management, and wildlife habitat development. The following sections summarize findings and recommendations for MCDEC and NOS Indian Head.

4.6.2 Installation 1: Marine Corps Development and Education Command (MCDEC)

4.6.2.1 General. The Quantico Marine base and ancillary tenant facilities are located in the coastal plain of Virginia, on the west bank of the Potomac River approximately 45 miles downstream from the limits of tidewater at the Fall Line above Washington, D.C. This reach of the Potomac is primarily undeveloped, and wooded on both shores. The installation lies between two tributary creeks, Quantico Creek to the north and Aquia Creek to the south, and has a small tributary creek within the base, Chopawamsic Creek. While the base is in Virginia, it borders on Maryland waters, for the Potomac estuary is considered Maryland waters to the Virginia creek headlands. The MCDEC covers over 56,000 acres and is located at Quantico, Virginia approximately 35 miles south of Washington, D.C., along the Potomac River. Mission activities include officer training and education, training of enlisted Marines in specialized areas, development and testing of military hardware, and training and evaluation of amphibious landing techniques.

4.6.2.2 Summary of Impact Potential and Recommended Actions. In Phase I of this study, MCDEC was screened in Study Group 2, based on concerns related to possible toxics in the storm drainage system, high erosion and sedimentation rates on the installation, and documented migration of leachate into surface waters from inactive landfills. The installation assessment methodology was applied to MCDEC during Phase II to better define (quantify) the likely character and extent of MCDEC's impact on local

receiving waters. As a result of this analysis, MCDEC remains in Study Group 2. Table 4.23 summarizes the areas of concern and recommended actions identified for MCDEC. As shown in this table, areas of concern include: possible existence of metals and organics in several of the storm drains; observed high erosion and sedimentation due to troop training and natural conditions; preliminary observation of leachate containing toxics reaching surface waters from inactive Table 4.23 Summary of Vicinity Verification of Surface Water Quality and Biological Productivity Conditions at MCDEC landfills; and occasional NPDES permit violations in the main STP. In general, there is a lack of data to adequately characterize the extent of impacts, if any, to local water quality from the above sources. Recommended actions for MCDEC include:

- Review of the Land Management Plan to ensure that best management practices are being implemented to curtail surface erosion;

- Develop a stormwater management plan to ensure that proper controls (i.e., oil/water separators, detention basins) are in place;

- Develop a periodic sampling program to characterize effluent quality from the various storm drains suspected of receiving heavy metals and toxics from miscellaneous industrial and maintenance activities;

- Proceed with NACIP Phase II confirmation studies to determine need, if any, for possible remedial measures to limit leachate migration from inactive landfills; and

- Review STP operations to determine cause and necessary operational changes to prevent future permit violations for BOD and TSS levels.

4.6.3 Installation 5: Naval Ordnance Station, Indian Head (NOS)

4.6.3.1 General. The Naval installation at Indian Head is partially divided by Mattawoman Creek, a tidal tributary containing wetlands. The Potomac shore is generally wooded, but there is extensive suburban and urban development in the area. Mattawoman Creek has been identified as one of Maryland's "critical areas", and plans are underway to establish parklands. The primary mission of the Naval Ordnance Station (NOS) at Indian Head is the handling of explosives and propellants including research and development as well as production. The Navy Explosive Ordnance Disposal (EOD) School and the Navy EOD Technology Center are tenant organizations on the bases. The installation consists of two separate bases, one occupying the Indian Head peninsula and the other across Mattawoman Creek to the south on Stump Neck. The area of both installations is about 3,423 acres of which approximately 50 percent is improved and 50 percent is unimproved land use.

Table 4.23 Summary of Areas of Concern and Recommended Actions for MCDEC-Quantico.

ACTIVITY/POLLUTANTS OF CONCERN	ONSITE	OFFSITE/VICINITY	RECOMMENDATIONS	ESTIMATED COST
Toxics from industrial discharges into combined storm drains	No information	No information	Monitor suspected outfalls for toxics and develop/implement stormwater management plan	<u>Plan Development</u>: $30,000 <u>Monitoring</u>: $40,000 (one time) 4 samples over one year
Erosion/Sedimentation, high production of SS from disturbed areas	Majority of sediments appear to be trapped by on-site ponds.	No information	Implement the grounds conservation section of the land management plan at MCDEC.	<u>Implement Plan</u>: $10,000
Toxics from recently closed landfill and old landfill	Elevated contaminant levels in stream drainage landfill. NEESA (1984) data - phenols = 4.4 μg/l; Cd = 0.08 μg/l Cr = 0.15 μg/l, Zn = 0.46 μg/l	No information available Confirmation study of old landfill currently in	Continue with RI/FS under Navy Installation Restoration Program.	$300,000
STP discharge permit violations for TSS	DMR data show frequent permit violations for TSS in Main STP. How- STP is in compliance for BOD and nutrients.	Potomac River exhibits algal blooms and general eutrophication (VSWCB,1986) Pollutant tolerant species exist in moderate numbers (VEPCO, 1979)	Continue with designs now underway to correct problems related to the STP digestor and secondary clarifier. Funds should be programmed to implement the corrective actions under design.	<u>Implement Design</u>: $50,000

NOS has just completed an application for a new NPDES Permit which is to cover 47 industrial and storm drainage outfalls and one sanitary outfall from a newly finished tertiary treatment plant.

4.6.3.2 **Summary of Impact Potential and Recommended Actions**. In Phase I of this study, NOS was screened in Study Group 1, based on the potential for migration of metals (silver, mercury) into local surface waters in Mattawoman Creek from several highly concentrated deposits in low-lying adjacent areas, and the potential presence of toxics in several industrial waste discharges. The installation assessment methodology was applied to NOS during Phase II to better define (quantify) the likely character and extent of NOS's impact on local receiving waters. As a result of this analysis, NOS remains in Study Group 1. Table 4.24 summarizes the areas of concern and recommended actions identified for NOS. As shown in this table, areas of concern include extensive shoreline erosion along the Potomac River side of Indian Head, high pollutant levels (COD/BOD, Oil & Grease, possibly nutrients) in the industrial waste discharges, and presence of metals and organic toxicants in the industrial discharges and in low-lying waste deposits. It is of interest to note that NOS and CHESDIV recognize these concerns and have already taken steps to determine possible alternatives for pollution abatement. These steps include conducting waste characterization studies for the industrial discharges, application of an updated NPDES permit to include monitoring for toxics, and ongoing investigation of the contaminated sites adjacent to Mattawoman Creek. There was a lack of adequate data in Mattawoman Creek (toxic levels in sediments and the water column) to determine how great, if any, the impact from NOS Indian Head on local water quality is. Recommended actions for NOS include:

- Continue to work closely with Corps of Engineers and State of Maryland regarding implementation of measures to control shoreline erosion rates;

- Examine treatment operations at the two Stump Neck STPs to determine cause and possible actions to improve compliance for residual chlorine (Note: a design project is underway to address this concern);

- The presence of a large number of industrial wastewater discharges at NOS is probably the area of primary concern for water quality in the vicinity of this installation. Although several of these discharges are known to contain low levels of toxics, available data are inadequate to characterize loading rates or to determine actual impact levels on surface waters. It is noted that NOS is coordinating with EPA and the State of Maryland on implementing a revised NPDES permit which will include a toxics monitoring program. Because of the controversy surrounding these activities, and in order to identify problem areas to ensure future compliance with State and EPA water quality standards, it is recommended that NOS adopt a seasonal or quarterly long term monitoring program for the local receiving waters around NOS. This program would be similar to those currently being performed at installations such as Aberdeen Proving Ground, Andrews Air Force Base, and Ft.

Table 4.24 Summary of Areas of Concern and Recommended Actions for NOS-Indian Head.

ACTIVITY/POLLUTANTS OF CONCERN	ONSITE	OFFSITE/VICINITY	RECOMMENDATIONS	ESTIMATED COST
Residual chlorine permit violations at Stump Neck STP	DMR data show frequent excess chlorine levels in effluent.	Impact level on Potomac River is probably low due to small discharge rate and dilution by river flow.	Continue with design currently underway to correct residual chlorine problem. Implement design changes.	$25,000
Shoreline erosion, suspended soldis, heavy metals	Shoreline erosion at NOS identified as priority area of concern by Corps of Engineers.	Corps estimates NOS contributes ≈ 0.26% of sediment load to Chesapeake Bay from shoreline erosion.	Implement Erosion Control Program.	Cost of erosion controls: $350/ft Plan update: $30,000
High levels of BOD/COD, nutrients, oil and grease, suspended solids, and possible heavy metals and organic toxicants from industrial discharges	48 industrial outfalls currently under study by NOS to upgrade treatment system and renew NPDES permit.	No information is available on toxics in vicinity of NOS. STORET data in Mattawoman Creek indicates elevated TSS levels downstream of discharge. NOS contributions poorly characterized.	Implement industrial waste treatment upgrades. If toxicity is shown in background data being obtained, develop effluent toxics monitoring program for industrial outfalls.	Treatment Costs: Unknown Develop Program: $40,000 Monitoring: $100,000 - 150,000
Metal deposits in drainage areas to Mattawoman Creek.	Confirmation studies indicate extensive contamination by silver and mercury and heavy metals (As, Cd, Pb, Hg, Ag, and Zn) onsite in area of drainage to Mattawoman Creek (CHESDIV, 1985)	No information on Matta-Creek available.	Develop long term monitoring program to detect possible migration of metals to Mattawoman Creek	Monitoring: $50,000 - $75,000 per year

Eustis. This program will also identify improvements in water quality conditions upon implementation of the planned improvements in the industrial wastewater system.

- As part of the Phase II confirmation studies, recommendations have been made to perform additional monitoring of sediments and water quality at all five of the confirmation sites. Due to the nature of sediments to be transported into deeper waters during storm runoff events, the possibility exists that contaminated sediments have accumulated in Mattawoman Creek. Ongoing sampling programs should include sediment sampling stations at locations in Mattawoman Creek in order to verify the presence or absence of sediment contamination.

4.7 REGION 6: POTOMAC RIVER ESTUARY

4.7.1 Tributary/Regional Description

4.7.1.1 **Environmental Setting.** The confluence of the Potomac River with the Chesapeake Bay is at Point Lookout, Maryland and Smith Point, Virginia. This reach of the Potomac is characterized by gently rolling land which slopes toward the river and is part of the Atlantic Coastal Plain. The Potomac River estuary is characterized by upper and lower segments. Salinity ranges from 7 ppt in the upper estuary to 13 ppt in the lower estuary. The mean tidal range is 1.2 feet at Point Lookout.

Upper Potomac Estuary. Although some oystering takes place in the area, this reach of the Potomac River marks the upstream limit of oyster bottom. The reach supports an extensive pound net fishery for spring runs of anadromous fish, as well as commercial crabbing. Upper Machodoc Creek, however, is closed to shellfish harvesting.

Calodon State Park, located along the reach, is known for large congregations of Bald eagles, and there are several active nests in the area.

The effects of overenrichment on the Potomac by nutrients are apparent in this area of the estuary. They include a relatively sharp transition from freshwater phytoplankton just above the reach at Maryland Point, to the typical estuarine diatoms and dinoflagellates dominating the summer community off Upper Machodoc Creek. In addition, there has been a documented loss of SAV and a decline of oyster spat set in the area, despite periods of high salinity. Levels of heavy metals in the water and bottom sediments do not appear to be excessive in this reach.

In the upper mesohaline Potomac estuary, at the bend of the Potomac River around Mathias Point neck, the Naval Surface Weapons Center, Dahlgren, Virginia, fronts on the Potomac and on Upper Machodoc Creek (see Figure 4.11). A few miles upstream on the north shore at the mouth of Nanjemoy Creek, is the Army's Blossom Point Proving Grounds. Both installations are in essentially forested surroundings, nearly rural in character.

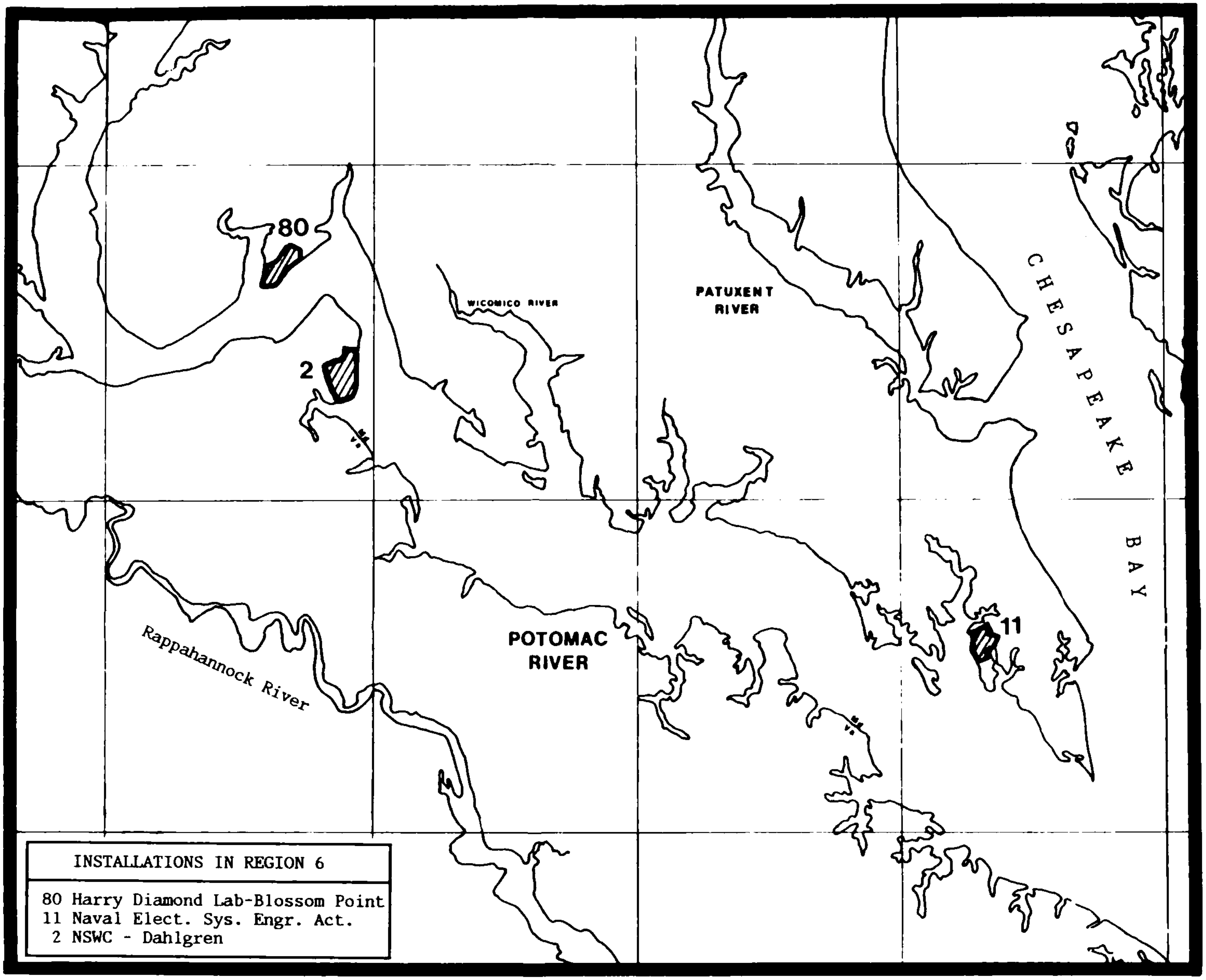


Figure 4.11 Region 6 - Potomac River Estuary

Lower Potomac Estuary. This area of the Potomac is generally forested and rural in character. Water quality in the area is good, with no obvious trends in nutrient enrichment or toxics contamination. The aquatic environment in this area is one of the few places in the state of Maryland where natural oyster reproduction is sufficient to support a "seed oyster" industry. This involves placing blank shell overboard in late spring for the larval "spat" to set on. In the summer, the shell are transplanted to growing waters elsewhere in the lower estuary where natural reproduction has not been successful. The "Jones Shore" is one of the best known seed beds in Maryland waters.

The area also supports large estuarine commercial fisheries, as well as a major sport fishery. There are some active eagle nests in the area, as well as a number of heron rookeries. The Naval Electronic Systems Engineering Activity is sited on the lower Potomac estuary, near St. Inigoes Creek (see Figure 4.11).

4.7.1.2 Vicinity Pollutant Loads

Vicinity Point Sources. There are two STPs currently discharging to the Potomac estuary as shown in Figure 4.6 and Table 4.13. The STPs have a combined average discharge flow of 0.7 MGD.

Table 4.14 presents estimates of metals from point sources (STPs) by county into the Potomac estuary (EPA, 1982). There are no known major industrial point sources for metals or toxic organics in the Potomac estuary.

Vicinity Nonpoint Sources. Upland areas represent the greatest source of conventional pollutants, particularly BOD, sediments, and nutrients, to the Potomac estuary. Nonpoint sources to the tidal Potomac can be separated into three major categories: 1) upstream loadings at the Fall Line at Chain Bridge; 2) combined sewer overflows (CSO) from urban areas in the District of Columbia and Alexandria, Virginia; and 3) local (below the Fall Line)tributaries to the Potomac Estuary. Table 4.15 presents estimates of upstream pollutant loadings at Chain Bridge over the years 1983 to 1984 (WASHCOG, 1985). Similar estimates for CSOs are not available; however, in 1983 an estimated 2.9 billion gallons (8 MGD) of untreated overflow were discharged from the District of Columbia's system (O'Brien and Gere, 1984). Similarly, no loadings estimates are available for the local tributaries below the Fall Line. These areas collectively make up about 12 percent of the total Potomac drainage basin area. Since the land use in the lower estuary is similar to that above the Fall Line (primarily rural and agricultural), a rough estimate of nonpoint source pollutant loadings is possible based on the ratio of surface area between a local drainage basin and the entire basin.

Nonpoint sources of metals to the Potomac estuary include atmospheric deposition, urban runoff, and upstream loadings at the Fall Line. Table 4.14 presents estimates of metals loadings from nonpoint sources (above Fall Line) to the Potomac estuary (EPA, 1982). There currently are no similar estimates of nonpoint source loadings of toxics to the Potomac estuary.

4.7.1.3 Relative Comparison to DoD Installation Pollutant Loads.

Point Sources. Of the three DoD installations in the Potomac Estuary Region, only NSWC Dahlgren operates a sewage treatment plant. The other two installations (HDL Blossom Point, NESEA) utilize septic systems and/or sand filters. The Dahlgren STP has a current discharge rate of 0.46 MGD and discharges directly to the Potomac River. Recent upgrades to the system have included polishing lagoons, digestors, a new chlorinator, and pretreatment for the circuit board manufacturing operation. The Dahlgren STP discharge is located at the boundary between the Transition and the Saline Zones of the Potomac estuary (see Figure 4.6). In this region, there are relatively few point source discharges as shown in Figure 4.6 and Table 4.13. Of the total contribution from point source discharges in the Transition and Saline Zones, Dahlgren accounts for only five percent of the BOD, three percent of the total suspended solids, and an estimated similar percentage of nutrients. Although it was not possible to estimate metals loadings from Dahlgren discharges, it is expected that the metal loadings are minor in comparison to the metals loadings from other point source discharges in the Potomac River. Due to a lack of information on toxics, a comparative analysis for toxics, if any, discharging from Dahlgren cannot be made. The potential for impacts from toxics discharged from Dahlgren point sources is expected to be minor because there are no major industrial wastewater discharges.

Nonpoint Sources. In terms of nonpoint source loadings, the DoD installations contribute a relatively small amount of pollutants to the Potomac estuary. Based on land surface area, these installations represent less than 0.1 percent of the total Potomac River drainage area (including above and below the Fall Line). At HDL Blossom Point (BPF), one apparent nonpoint source concern involves the severe erosion rates along the Potomac River shoreline. The Corps of Engineers has estimated that erosion along Blossom Point contributes approximately 0.13 percent of the sediment load to the Chesapeake Bay on a Bay-wide basis (U.S. Army, 1985). At Dahlgren, potential nonpoint source concerns relate to impervious area runoff, widescale application of herbicides and pesticides, and potential fuel spills from the large fuel storage system. At both Blossom Point and Dahlgren there exist widespread scattering of ordnance in wetlands and open water areas. These activities have destroyed large areas of wetlands at Blossom Point. The impact of ordnance in open water areas, if any, is poorly understood.

4.7.1.4 Summary of DoD Impacts on the Potomac River Estuary.

The locations of the three DoD installations in this region are shown in Figure 4.10. In Phase I, NSWC Dahlgren and HDL Blossom Point were estimated to have a likely significant potential for adverse water quality impacts by nature of their proximity to the Bay and the activities on the installations. These installations were evaluated in greater detail during Phases II and III of this study. The third installation, NESEA, was estimated to represent a poorly defined but likely insignificant potential, and was not subject to further analysis.

Table 4.25 presents the results of the final screening of these installations. The assignment to Study Groups (impact categories) remained unchanged after the final screening. Areas of concern at Blossom Point include widespread ordnance impact, exposure of a landfill by shoreline and bluff erosion and possible exposure by same of additional landfills and/or septic systems, and uncertain status of contaminant migration from several inactive landfills and burn/detonation pits. Concerns at Dahlgren also include widespread impact from ordnance firing, stormwater runoff, and potential contaminant migration into local wetlands from past discharges from industrial operations (gun barrel decoppering and degreasing). In general, there is a lack of adequate data to characterize the levels of impact and sources of contamination from these two installations.

Other than the widespread scattering of ordnance at Blossom Point and over a large area of the Potomac River near Dahlgren, the region of influence of these installations in the Potomac River estuary is probably limited to the immediate vicinity of each installation. An environmentally beneficial effect at Blossom Point is essentially the non-development of this site which has helped to maintain a rich diversity of habitat and its utilization by wildlife, waterfowl and fish. Positive activities at Dahlgren have included several upgrades to the sewage treatment systems, construction of a new hazardous waste storage facility, and development of an active natural resources program, including soil conservation and habitat enhancement and protection. The following sections summarize findings and recommendations for the three installations in this region.

4.7.2 Installation 2: Naval Surface Weapons Center - Dahlgren

4.7.2.1 **General.** Dahlgren is located in King George County, Virginia, approximately 53 miles south of Washington, D.C. The main installation (2,677 acres) is separated from the Explosive Experimental Area (EEA) (1,614 acres) by Machodoc Creek. Both sites drain into the Potomac River. The primary mission of Dahlgren as part of the Naval Surface Weapons Center is to support administrative, research, development, housing, and community activities. The EEA is utilized exclusively for testing of naval ordnance.

4.7.2.2 **Summary of Impact Potential and Recommended Actions.** In Phase I of this study, Dahlgren was screened in Study Group 2, based on the potential for contamination from stormwater runoff, erosion/siltation, unpermitted minor industrial discharges, widespread scattering of ordnance, and potential migration of toxicants from past disposal practices. The installation assessment methodology was applied to Dahlgren during Phase II to better define the likely character and extent of Dahlgren's impact on local receiving waters. As a result of this analysis, Dahlgren remains in Study Group 2. Table 4.26 summarizes the areas of concern and recommended actions identified for Dahlgren. The primary areas of concern include unknown level of impacts from ordnance firing, and potential contamination migration from past disposal activities. There is an inadequate data base on and in the immediate vicinity of this installation to quantify pollutant

Table 4.25 Summary of Final Screening for Installations in the Potomac Estuary Region

ID	Branch	Installation Name	ON-SITE SCREENING CRITERIA (ON-SITE IMPACT POTENTIAL)																							
			NON-POINT SOURCES				POINT SOURCES			HAZARDOUS/TOXIC MATERIALS											ENVIRONMENTAL PROGRAMS					
			1. Erosion/Sedimentation	2. Impervious Area Runoff	3. Combined Storm Drains	4. Shoreline Erosion	5. Sewage Treatment	6. Industrial Waste Treat	7. Intermitt Sewage Treat	8. Refueling Operations	9. Munitions Operations	10. Chemical Operations	11. Pesticides	12. Vehicle Maintenance	13. Ship Maintenance	14. Solid Waste Disposal	15. Hazardous Waste	16. SPCC Status	17. Abandoned Sites	18. LUST Status	19. Forestry Mgmt. Plan	20. Wildlife Mgmt. Plan	21. Soil Conservation Plan	22. Stormwater Mgmt. Plan	23. Wetlands Mgmt. Plan	24. Shoreline Erosion Plan
80	ARMY	HDL - Blossom Point	Θ	·	·	Θ	·	·	Θ	·	Θ	·	-	·	·	·	·	+	Θ	-	-	Θ	Θ	·	Θ	Θ
2	NAVY	Nav Sur Wea Ctr-Dahl.	+	-	-	+	+	-	·	-	Θ	-	+	·	·	·	+	+	Θ	·	+	+	+	+	+	+
11	NAVY	Naval Elect. Sys Eng	+	·	·	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	+	+	+	+	+	+

ID	Branch	Installation Name	VICINITY SCREENING CRITERIA: RELATIONSHIP TO LOCAL ENVIRONMENT							STUDY GROUP: IMPACT POTENTIAL			
			25. Shellfish Areas	26. SAV Areas	27. Fish Spawning Areas	28. Wetlands Areas	29. Waterfowl Nesting	30. Endangered Species	31. Relative Local Impact	1. Significant	2. Poorly Defined, Sig.	3. Poorly Defined, Insig.	4. Insignificant
80	ARMY	HDL - Blossom Point	Θ	-	-	Θ	Θ	-	Θ	X			
2	NAVY	Nav Sur Wea Ctr-Dahl.	-	-	-	-	-	-	-		X		
11	NAVY	Naval Elect. Sys Eng	+	-	-	+	+	+	·			X	
		Total Number of Installations per Study Group								1	1	1	0

Score Totals

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
·	0	2	2	0	1	2	2	2	1	2	1	3	3	3	2	1	1	2	0	0	0	1	0	0	0	0	0	0	0	0	1
+	2	0	0	2	2	0	0	0	0	0	1	0	0	0	1	2	0	0	2	2	2	2	2	2	1	0	0	1	1	1	0
⊕	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-	0	1	1	0	0	1	0	1	0	1	1	0	0	0	0	0	0	1	1	0	0	0	0	0	1	3	3	1	1	2	1
Θ	1	0	0	1	0	0	1	0	2	0	0	0	0	0	0	0	2	0	0	1	1	0	1	1	1	0	0	1	1	0	1

KEY: Impact Category 1: { Θ Significant Impact Potential (Adverse)
⊕ Significant Impact Potential (Beneficial)

Impact Category 2: { - Unknown or Poorly Defined Impacts (Adverse)
\+ Unknown or Poorly Defined Impacts (Beneficial)

Impact Category 3: · Insignificant Impact Potential (Adverse or Beneficial)

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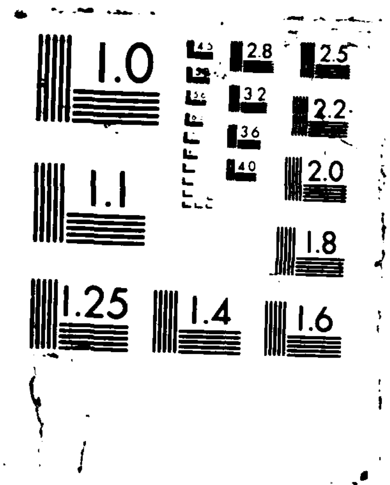
1.0
2.8
2.5
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2.2
3.6
4.0
2.0
1.1
1.8
1.25
1.4
1.6

Table 4.26 Summary of Areas of Concern and Recommendations for NSWC - Dahlgren.

ACTIVITY/POLLUTANTS OF CONCERN	ONSITE	OFFSITE/VICINITY	RECOMMENDATIONS	ESTIMATED COST
Sewage Treatment Plant - residual chlorine	DMR data from 6/85-6/86 show average of 16 exceedences per month of NPDES permit limits for residual chlorine; 27 exceedences/month are allowed under the NPDES permit. Several recent major upgrades to the STP have improved overall performance.	Mean total residual chlorine in 1985 in Williams Creek was 0.0125 mg/L and in Upper Machodoc Creek was 0.0 mg/L (VSWCB, 1986).	Continue with current design to correct chlorine problems. Implement design changes to STP.	STP Upgrades: $25,000 - $50,000
Ordnance firing into Potomac River	Heavy contamination of unexploded ordinance (UXO) onsite at EEA.	Widespread contamination of Potomac River with UXO.	If possible, limit active firing area and avoid wetlands.	cost unknown
Nonpoint source contaminants - herbicides application, ordnance, runoff from impervious areas	Widespread application of herbicides on EEA, and heavy impaction of EEA by ordnance. Past disposal practices for gun barrel degreasing & decoppering may contribute to nonpoint runoff.	Limited data for gun barrel maintenance operations shows possible minor contamination of drainage pathway. No data exist for runoff from EEA.	Develop stormwater management plan to include periodic wet weather monitoring to determine possible need for control and/or cleanup.	Develop Plan: $30,000 Monitoring: $70,000 (seasonal, for one year)

sources and water quality impacts, if any. Recommended actions for Dahlgren include:

- Although the Grounds Conservation Management Plan is adequately addressing erosion and siltation at Dahlgren, the Plan should be updated to include a stormwater management plan. Assistance in preparing this plan is available through local planning agencies and CHESDIV. The plan should focus on control/containment of potential fuel spills, upgrading or adding oil/water separators where necessary, and monitoring and control of erosion and sedimentation. (Note: NSWC plans to install oil/water separators in FY88.)

- The Natural Resources program at Dahlgren appears to be active but its effectiveness is unknown. There are many ecological resources located along the installation's shoreline including shellfish, SAV's, fish spawning areas, wetlands, and waterfowl nesting areas. Therefore, it is recommended that Dahlgren make every effort to insure effective protection and management of these valuable resources.

- Data are not available to assess possible impacts from the widespread scattering of ordnance both in the Potomac River and on the installation land surface, the widespread application of herbicides and pesticides on the EEA, the removal of ground cover in the EEA area from ordnance impact/burning and herbicide application, and past disposal practices for gun barrel maintenance near Gambo Creek. It is noted that the application of herbicides on the EEA is required for fire hazard safety reasons. Also, the ordnance impact area is essential to the mission of NSWC Dahlgren. In order to identify problem areas to ensure future compliance with State and EPA water quality standards, it is recommended that Dahlgren adopt a seasonal or quarterly long term monitoring program for the local receiving waters around Dahlgren. This program would be similar to those currently being performed at installations such as Aberdeen Proving Ground, Andrews Air Force Base, and Fort Eustis.

4.7.3 Installation 80: Harry Diamond Labs - Blossom Point Field Test Facility (BPF)

4.7.3.1 General. BPF occupies 1600 acres in a rural setting on Cedar Point Neck in the southern tip of Charles County, Maryland. The installation is located approximately 50 miles south of Washington, D.C. and 9 miles southwest of La Plata, Maryland, on the Potomac River. As a satellite installation of Harry Diamond Laboratories (HDL), Blossom Point is used as a proving ground and firing range by HDL's Field Test Group Fuse Exploratory Development Program to support research at HDL. The major mission of the facility is to conduct field tests of fuses, explosives, and pyrotechnic devices, and electronic telemetry systems.

4.7.3.2 Summary of Impact Potential and Recommended Actions. In Phase I of this study, BPF was screened in Study Group 1 based on: uncontrolled shoreline erosion which is threatening exposure of abandoned landfills, a historic structure, septic drainage fields and valuable wetlands and woodlands; weapons testing impacts on wetlands and the Potomac River; the presence of eight landfills for which no confirmation study has been started; and, the very rich habitat within and surrounding the installation.

The installation assessment methodology was applied to BPF during Phase III to better define (quantify) the likely character and extent of its impact on local receiving waters. As a result of this assessment, BPF has remained in Study Group 1 because of: the continued destruction of forest and wetlands by ordnance testing; the precarious location of eight abandoned landfills in areas of high erosion and close proximity to the River and/or wetlands; the lack of testing at the eight landfills and two burn pad sites to identify constituent presence and confirm or deny migration; the uncontrolled shoreline erosion in an area of productive shellfish beds and SAV; lack of testing of USTs for leaks; and, uncleaned and uninspected septic systems one of which is threatened by erosion. On the positive side, BPF's beneficial impacts result from the non-development of the site which helps to maintain the rich diversity of habitat and its utilization by wildlife, waterfowl, and fish. Table 4.27 summarizes the areas of concern and recommended actions identified for BPF.

Recommended actions for BPF include:

- Construction of a man-made water impact site for ordnance testing in lieu of marsh or river impact sites;
- Remedial measures to clean up and prevent further exposure of landfills adjacent to eroding shorelines;
- Conduct confirmation studies at the eight landfill and two burn pad sites;
- Implement a shoreline erosion control plan;
- Test three POL tanks onsite for leaks; and,
- Inspect/clean/replace two septic systems as required.

4.7.4 Installation 11: Naval Electronics Systems Engineering Activity (NESEA)

4.7.4.1 General. NESEA is located in St. Mary's County, Maryland, approximately 75 miles south of Washington, D.C., and covers 852 acres of land. The NESEA is located on St. Mary's River, a tributary of the Potomac River. The primary mission of NESEA is to provide electronic support for electronic systems and equipment as well as to serve as a test and evaluation center for electronic systems.

Table 4.27 Summary of Areas of Concern and Recommendations for Harry Diamond Labs - Blossom Point Field Test Facility

ACTIVITY/POLLUTANTS OF CONCERN	ONSITE	OFFSITE/VICINITY	RECOMMENDATIONS	EST. COST
Ordnance testing with impact areas in wetlands, woodlands and Potomac R./explosives, chemicals, isotopes	Destruction of prime habitat for terrestrial and aquatic species. Endangered species - bald eagle & whorled water pennywort - could be destroyed	Impact, turbidity, chemical/metals pollution in oyster/clam area and fish spawning/migration regions	Construct man-made water impact area or restrict testing to nonwooded open area designated for this use.	<u>Develop wetlands Mgmt. Plan</u>: $40,000 <u>Man-made water impact area</u>: Cost unknown
Eight landfills identified for past and present disposal practices/shell casings, chemicals, construction debris, fuze components, waste film, reagents	Potential for chemical and explosives leachate migration from landfills needs to be checked. Riverine and wetlands habitats could be impacted.	One site already exposed by shoreline erosion has spread rocket bodies & shell casings along the beaches adjacent to landfill	Conduct confirmation study to ascertain if migration is occuring from any of the landfill sites. Remedial action should follow as indicated by study results.	<u>Confirmation study</u>: $200,000 +
Burn pit/Detonation pad sites (impact area 1 & 2)/ordnance, chemicals, propellants	Hazardous waste residue from burning/detonation needs to be identified/quantified	Potential exists for groundwater contamination migration to Potomac River and nearby creeks.	Handle trash impact areas as confirmation sites to be tested along with landfills for offsite migration.	<u>Confirmation study</u>: $50,000-$100,000

Table 4.27 Summary of Areas of Concern and Recommendations for Harry Diamond Laboratory Blossom Point Field Test Facility (BPF) (Continued)

ACTIVITY/POLLUTANTS FOR CONCERN	ONSITE	OFFSITE/VICINITY	RECOMMENDATIONS	ESTIMATED COST
Shoreline erosion/erosion and sedimentation	Destruction of wetland and woodland habitat, loss of historic structure, exposure of landfill sites and contents	Turbidity generated has effect on clam/oyster beds and SAV areas. If landfills are exposed, leachate may affect local environment.	Supplement best management practices to control shoreline erosion especially along shoreline where landfills are located	Protect landfills and two impact areas: $800,000 Develop control plan: $50,000
Underground storage tanks/fuel oil, diesel fuel	Leak testing of tanks is necessary	LUST potential to contaminate ground-water for offsite migration.	Leak test these tanks. Replace if leaking and institute remedial measures if needed.	Test: $400-$700/tank
Septic systems/domestic waste, viral agents		Erosion threatens exposure of leach field and release of bacteria and viral agents into Nanjemay Creek	Check, clean and replace/relocate system as necessary after inspection.	$60,000

4.7.4.2 <u>Summary of Impact Potential and Recommended Actions</u>. The screening data for NESEA are presented in Tetra Tech (1986). Based on the screening criteria, NESEA was screened in Study Group 3, having a poorly defined but likely insignificant potential impact level on the ecological resources of the Chesapeake Bay (see also Table 4.25). This judgement is based on the following observations:

a. NESEA has some minor erosion problems along the shoreline of St. Mary's River. The installation has agricultural outleases and the potential exists, although minor, for increased siltation and contamination due to farming activities. Best Management Practices are implemented at all agricultural outleases on Navy property.

b. NESEA has a septic tank and sand filter to treat domestic wastewater. There are only minor industrial discharges into the system. The plant has been in frequent non-compliance for dissolved oxygen, flow rate and B.O.D. The non-compliance appears to be due to population and facility growth at the station. (Note: A package plant has recently been installed and is in compliance.)

c. St. Mary's River has an oyster, clam, and blue crab fishery adjacent to the installation. The 54 acres of onsite wetland habitat is a recognized area of importance to aquatic wildlife and water fowl.

NESEA's limited potential impact is a result of poorly defined effects from small scale erosion and minor agricultural activity. The installation was not examined further in Phase III of this study. A recommended action for NESEA relates to the need to address erosion control and is summarized in Chapter 5.

4.8 REGION 7: RAPPAHANNOCK RIVER

4.8.1 <u>Tributary/Regional Description</u>

4.8.1.1 <u>Environmental Setting</u>. Fort A. P. Hill drains primarily to the Rappahannock River with a portion also draining to the York River via the Mattaponi River (see Figure 4.12). This section focusses on the Rappahannock system, but also includes information on the Mattaponi.

The Rappahannock River watershed is primarily an agricultural and forested area with little urban or industrial development. Water quality in the Rappahannock is generally good with few major industrial or municipal effluents. The river functions as a spawning and nursery grounds for a number of anadromous and marine species and the non-tidal freshwater portion also supports a high diversity of freshwater fish.

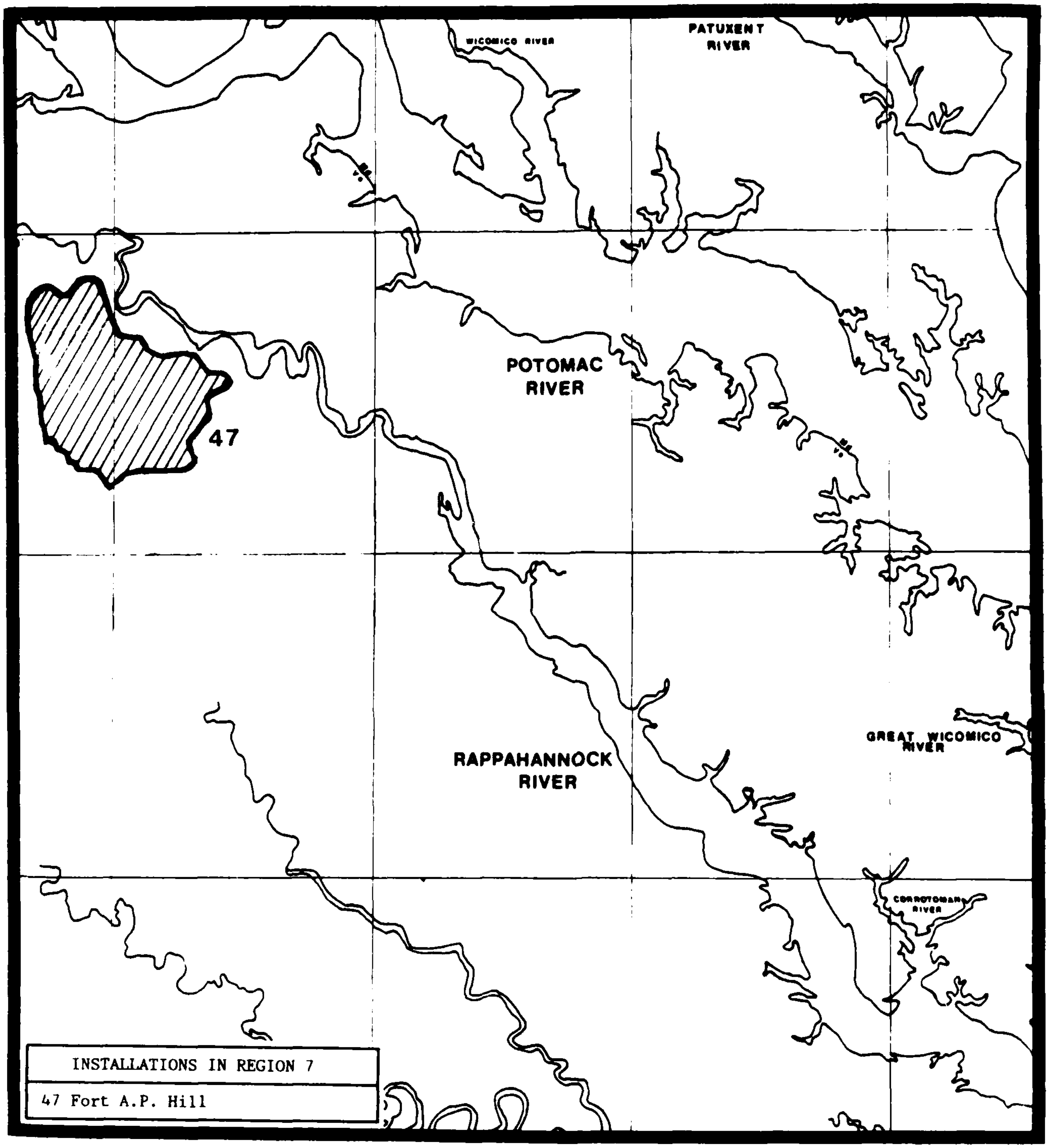


Figure 4.12 Region 7 - Rappahannock River (Fort A.P. Hill)

Specific water quality problems reported in the Rappahannock River include elevated fecal coliform levels, seasonally low dissolved oxygen concentrations, and nutrient enrichment. The EPA Chesapeake Bay Program concluded that phosphorus and total nitrogen enrichment in the Rappahannock were due primarily to nonpoint sources, including both agricultural and forestry-related activities. The nearby Mattaponi River Watershed, which also includes minor tributaries from Fort A. P. Hill and which discharges into the York River, has had some minor pH violations which are attributable to natural conditions. There are no significant point source discharges in these two systems although several minor ones exist, including sand and gravel operations. Infrequent fecal coliform violations in the Rappahannock River are due to natural conditions and upstream point source discharges. Elevated nickel levels have been detected in water samples at levels above the EPA criteria for human health and fish consumption but the source of the nickel is unknown. The surface waters on A. P. Hill have been designated Class III waters by the Commonwealth of Virginia.

4.8.1.2 Vicinity Pollutant Loads

Vicinity Point Sources. Municipal and industrial wastewater treatment facilities contribute to the conventional pollutant loading of the Rappahannock and Mattaponi River systems. Major dischargers on the Rappahannock River and their associated conventional pollutant loadings are listed in Table 4.28. The combined flow of these discharges is 5.2 MGD. For the most part, industries along the Rappahannock are small firms concerned with textiles, lumbering, metal finishing, sand and gravel mining, and seafood processing. According to VASWCB, 1986, industrial development in this region is proceeding at less than average rates.

Vicinity Nonpoint Sources. Fifty-two percent of the land in the Rappahannock basin is forested and 35 percent is agricultural, whereas 70 percent is forested and another 22 percent is cropland and pasture in the York basin. Only about 2 percent of the land is classified as urban in both basin areas. Nonpoint sources of pollutant loadings are from agricultural land use, atmospheric deposition, urban runoff, and upstream loadings at the Fall Line. These pollutant loadings include BOD, sediments, nutrients, metals, and biocides such as pesticides and herbicides. There are no quantitative estimates available for nonpoint source pollutant loadings in this drainage basin.

4.8.1.3 Relative Comparison to DoD Installation Pollutant Loads

Point Sources. Fort A. P. Hill is the only DoD installation in the Rappahannock River Basin. The two sewage treatment plants at A. P. Hill which discharge to surface waters (Wilcox Camp and Headquarters) are included in Table 4.28. These discharges represent approximately 5 percent or less of the total conventional pollutant loadings entering the Rappahannock River from point sources.

TABLE 4.28 POINT SOURCE CONVENTIONAL POLLUTANT LOADINGS TO THE RAPPAHANNOCK RIVER*

CODE	NPDES	NAME	LOADING (lbs/DAY)							FLOW
			BOD_5	NH_3	TKN	TN	PO_4	TP	TSS	(MGD)
1	26263	Urbana, Town of	14.2	12.6	15.4	17.3	4.9	6.0	21.8	0.11
2	28096	Claiborne Run STP	87.0	87.7	106.9	120.2	33.7	41.6	60.4	0.78
3	20265	Tappahannock, Town of	55.2	22.9	28.9	31.9	8.6	10.8	89.9	0.20
4	26891	Warsaw, Town of	6.2	7.6	9.2	10.3	2.3	3.6	6.7	0.07
5	23931	Cheltenham Boys Village	8.3	4.5	5.5	6.2	2.0	2.3	8.3	0.04
6	25127	Fredericksburg City STP	525.0	316.3	373.4	433.3	111.8	131.5	448.4	2.46
7	25658	Spotsylvania Co. - Messaponox	213.0	122.2	146.8	167.4	63.0	78.2	327.9	1.50
8	32034	A. P. Hill - Wilcox Camp	32.4	-	-	-	-	-	46.9	0.04
9	31941	A. P. Hill - Headquarters	9.7	-	-	-	-	-	53.0	0.011
		TOTAL	951.0	573.8	686.1	786.6	226.3	274.0	1063.3	5.21

*Based on Summer 1984/1985 conditions reported by USEPA (J. Macknis, Personal Communication)

Nonpoint Sources. Fort A. P. Hill's surface area is about 76,000 areas. This represents approximately 2% of the total drainage area to both the Rappahannock and York Rivers. No information is available to estimate the quantity of nonpoint source pollutant loads for this area.

4.8.1.4 Summary of DoD Impacts on the Rappahannock River

With the possible exception of sedimentation, the relative contributions of point and nonpoint pollutant sources to the Rappahannock and York Rivers from Fort A. P. Hill are probably insignificant. Erosion, however, is a potential problem that needs to be properly addressed to prevent adverse impacts on local water quality conditions. The erosion of disturbed areas at A. P. Hill is being mitigated to a large degree by the trapping of sediment in natural retention basins formed by ponds and lakes on the installation.

Water quality conditions in the general vicinity of Fort A. P. Hill are good. There are nonpoint source pollutant loadings that are causing eutrophication problems. There is also a slight elevation of nickel concentration in the Mattaponi River Watershed. These problems are believed due to nonpoint source runoff from surrounding agricultural areas as well as from municipal and industrial point sources. Fort A. P. Hill's contributions are probably insignificant, except possibly directly on the installation. The following section summarizes the findings and recommendations for Fort A. P. Hill, the only installation in this region.

4.8.2 Installation 47: Fort A. P. Hill

4.8.2.1 General. Fort A. P. Hill covers over 76,000 acres and is located approximately 20 miles southeast of Fredericksburg, Virginia, between the Rappahannock and Mattaponi Rivers. Drainage from this installation occurs via six streams and seven streams feeding into the above rivers, respectively. The primary mission at Fort A. P. Hill is to provide support and training areas for active units and reserve components of the Army, other military services, and government agencies.

4.8.2.2 Summary of Impact Potential and Recommended Actions. In Phase I of this study, Fort A. P. Hill was screened in Study Group 2, based on the large size of the installation and the potential for nonpoint source pollutant runoff, erosion, and STP discharges. The installation assessment methodology was applied to A. P. Hill during Phase III to better define the likely character and extent of A. P. Hill's impact on local receiving waters. As a result of this analysis, A. P. Hill remains in Study Group 2. Table 4.29 summarizes the areas of concern and recommended actions for A. P. Hill. As shown in this table, areas of concern include continuous NPDES permit violations for high chlorine levels at the two installation STP's, lack of treatment for shower and kitchen facilities at decentralized camps, erosion of disturbed areas (troop training and timber clear-cutting), widespread herbicide/ pesticide application with the potential for runoff into local streams, and lack of a current SPCC plan. Inadequate data exist

Table 4.29 Summary of Areas of Concern and Recommendations for Fort A. P. Hill

ACTIVITY/POLLUTANTS OF CONCERN	ONSITE	OFFSITE/VICINITY	RECOMMENDATIONS	EST. COST
Sewage Treatment Systems BOD, TSS, Cl_2, DO	DMR data shows Camp STPs are in violation with permit limits for chlorine. No treatment of camp shower and kitchen grey water.	No local water quality problems observed.	Feasibility study for sewage system upgrades. Connection of outlying camps to centralized STP. Upgrade treatment units.	Upgrades: $100,000 - $300,000 Package STP's at camps: $200,000 - $500,000
Erosion/Sedimentation	Sedimentation occurs in onsite streams, but natural basins trap sediments.	Offsite impacts believed minor	Review Natural Resources Plan and Training Procedures to implement Best Management Practices. Reclaim erosion areas	Plan review: $50,000 Restoration costs: unknown
Herbicide/Pesticide Applications	Master Plan reports occurrence of elevated metals and chemicals in onsite streams	Offsite impaces believed minor	Strict management of biocides applications	$25,000 per year labor
Oil and Hazardous Substances Control	Vehicle wash racks and o/w separators are overloaded causing oil and grease discharge to streams; AEHA (1985) showed POL and DDT levels elevated in ground water near POL storage area	Offsite impacts believed minor	Review and update SPCC plan and Hazardous Waste Plan. Construction of berm around storage facility. Implement field monitoring recommendations identified by AEHA.	Plan review/update: $40,000 Monitoring: $100,000 Berm construction and o/w separator $50,000 - 100,000

to quantify the potential environmental impacts, if any, on receiving waters from A. P. Hill's activities. Available data in the Rappahannock and Mattaponi Rivers, however, indicate relatively good water quality conditions downstream of A. P. Hill's influence. It should be noted that the environmental staff at A. P. Hill have made considerable progress in cleaning up past pollutant sources and spills. They have maintained a very active natural resources program to limit erosion and to enhance local wildlife habitats. Continuation of such programs and policies, plus better coordination with training activities on the installation, could further reduce A. P. Hill's potential for environmental impacts. Recommended actions for A. P. Hill include:

- Perform a feasibility analysis of small volume wastewater collection, treatment, and disposal alternatives to serve the expanding needs of training camps. Consider year-round sewage treatment systems where seasonally used systems also operate to satisfy emergency requirements.

- Examine the cause of chlorine permit violations at the Wilcox and Post Headquarters STPs. Correct deficiencies as necessary. Also correct the flow equalization problem at the Post Headquarters STP.

- Check the need for modifying the existing wash rack oil/water separators to adequately handle heavy use. Provide minimal treatment of wastewater from kitchen and shower facilities to remote camps.

- Review the natural resources plan with special regard to the relationship of erosion controls and the military training mission at the post. Provide immediate reclamation for areas exposed by training activities. Examine the practice of clear cutting and potential alternatives for forest management.

- Provide strict management of biocides applications to prevent soil erosion and introduction of chemicals into local receiving waters.

- Update the SPCC and Hazardous Waste Management Plans to ensure full compliance with RCRA/TSCA regulations. Carry out AEHA recommendations for stream and groundwater quality monitoring local to inactive landfills and past chemical spill sites.

4.9 REGION 8: YORK RIVER ESTUARY

4.9.1 Tributary/Regional Description

4.9.1.1 Environmental Setting. The York River basin, the third smallest in the Bay drainage area, has the smallest percentage of urban land use. The river lies within the Atlantic Coastal Plain Province, whereas the upper reaches of the Pamunkey and Mattoponi, tributaries to the York, extend into the Piedmont Province. The headwaters rise in Orange County and flow

approximately 120 miles to the confluence with the Chesapeake Bay at Yorktown. The spring tidal range varies from 2.6 feet at Tue Marshes Light to 4.5 feet at Walkerton on the Mattaponi River.

Lower York Estuary. Along the lower York estuary, the shores are rural and forested, with some small wetlands. The tidal amplitude of approximately 2.2 feet creates a relatively large tidal prism. This results in turbulent mixing and flushing of the estuary, which helps remove pollutants and oxygenate bottom waters. Salinity varies from 7 to 13 ppt.

Water quality in the lower York estuary is generally good. Occasionally during the summer, some of the deeper channels have low dissolved oxygen, but they do not become anoxic. Bacteriological quality in the region is generally good, but some areas, including Wormley Creek, have restrictions on shellfishing.

The reach has good oyster growing bottom, with both public (Baylor) grounds and leased bottom. The reach also has hard clam and soft shell clam habitat. Further, the reach supports the typical Chesapeake estuarine commercial finfishery, and a popular sport fishery for finfish and shellfish. The region also serves as an overwintering ground for migrating waterfowl and summer habitat for many shorebirds.

The 15 mile reach of the lower York estuary has four DoD installations along its south shore (see Figure 4.13). They include Camp Peary, Naval Supply Center - Yorktown, Naval Supply Center - Cheatham Annex, and Naval Weapons Station - Yorktown.

Back River. The Langley Air Force Base is bounded by the northwest and southwest branches of the Back River, a small tidal embayment off Chesapeake Bay between the York and James Rivers. The land is primarily forested, but intense urbanization is occurring in the watershed. Substantial acreages of leased oyster growing grounds are nearby but some portions of the creeks and branches are closed to shellfishing.

This area serves as a nursery area for the estuarine dependent species. There is little freshwater inflow to the system, so spawning of the anadromous fish would not be expected.

Water quality is considered good, with adequate dissolved oxygen, low nutrients, and generally good bacteriological quality, except for the shellfish closure areas.

4.9.1.2 Vicinity Pollutant Loads

Vicinity Point Sources. The York River receives wastewater from a small number (approximately 10) of industries and municipalities as listed in Table 4.30 and located on Figure 4.13 (Sturm, 1977 and EPA, 1982). As can be seen from Table 4.30, the industrial discharge of Chesapeake Corp. represents the largest flow with the highest level of BOD5 and TSS contributions into the York River. However, the York STP represents the largest point source nutrient loading based on output of nitrogen and

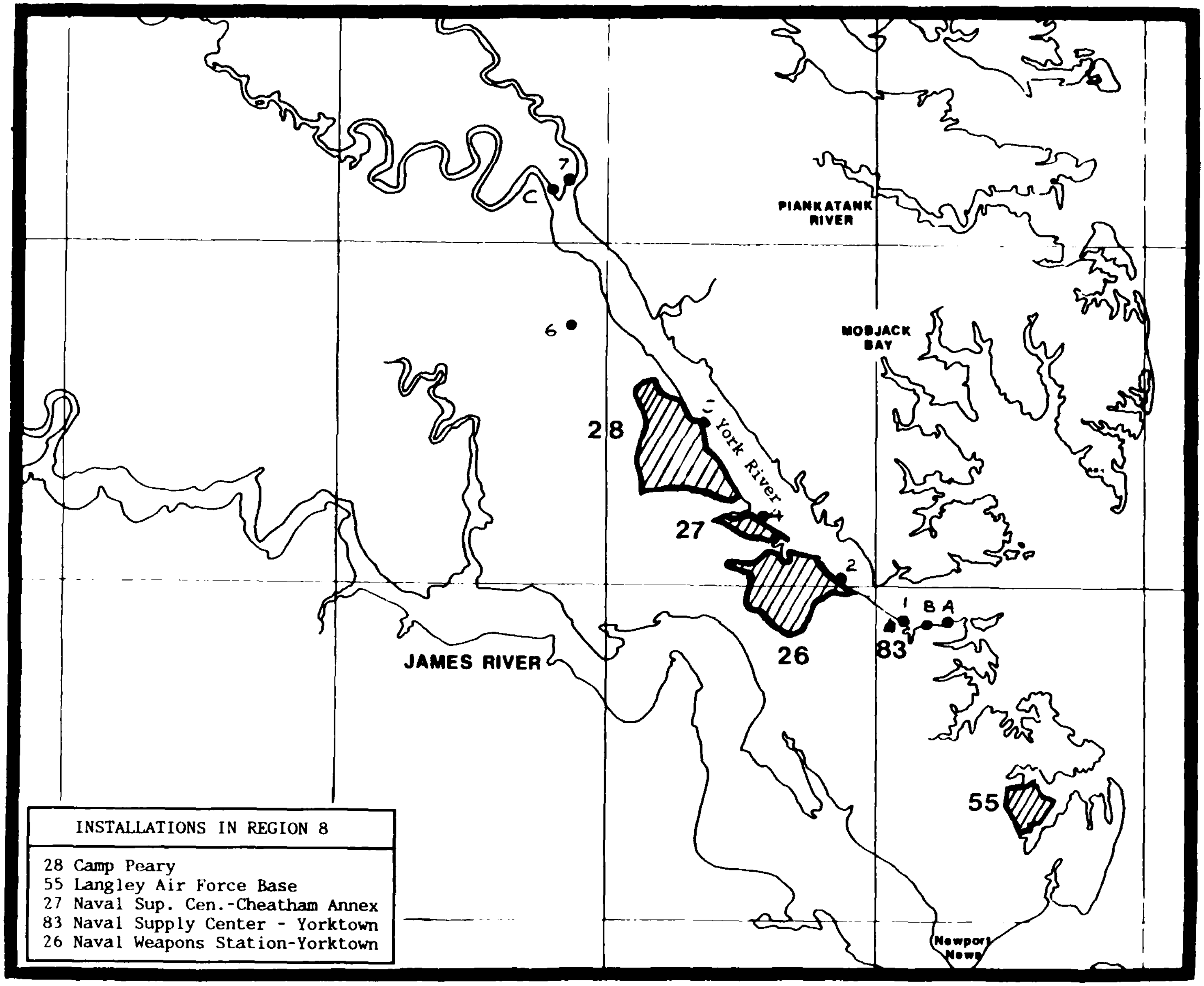


Figure 4.13 Region 8 - York River Estuary

Table 4.30 York River Point Source Discharges

Point Source	Flow MGD	BOD_5 lb/day	NH_3 lb/day	TKN lb/day	TN lb/day	PO_4 lb/day	TP lb/day	TSS lb/day
A. Amoco Oil Co.[1]	1.34	48.0						
B. York STP[1] (includes VEPCO)	5.82	508.9	368.9	483.8	1111.0	285.5	369.4	490.1
C. Chesapeake Corp.[1]	13.78	5739.6	230.0	230.0	316.3	-	320.0	8984.8
1. Coast Guard School[2]	0.05	21.0						
2. Yorktown Colonial Park[2]	0.05	46.0						
4. Cheatham Annex	0.10							
5. Camp Peary[2]	0.06							
6. Town of Toano[2]	0.015	36.0						
7. Town of West Point[1]	0.41	75.9	45.8	55.8	62.8	18.5	21.7	93.1

Notes: 1 Data from Chesapeake Bay Program Database

2 Data from Sturm 1977 represents 1976 data

phosphorus. The total flow from these point sources is 21.7 MGD with 90 percent being discharged from the Chesapeake Corp. and York STP's alone.

Vicinity Nonpoint Sources

Nonpoint sources of pollution in the York River Basin include urban runoff, farm runoff, marsh detritus and boating and shipping activities. Currently, only a small percentage of the basin can be classified as urban, however, the potential growth is greatly stimulated by the expansion from the Hampton-Newport News area. Farm runoff is probably a major nonpoint source contributor of fertilizers, pesticides, animal wastes and sediment entering the river and its tributaries.

Large naval craft navigate the York River to call at Cheatham Annex and the Naval Weapons Station. In addition, tugboats, fishing vessels and recreational watercraft are significant users of the estuary. There are no quantitative estimates available for nonpoint source pollutant loadings in this system.

4.9.1.3 Relative Comparison to DoD Installation Pollutant Loads

Point Sources. The Cheatham Annex STP discharge of 0.1 MGD is scheduled for connection to the HRSD sewer system in FY88 while the Camp Peary discharge of 0.06 MGD is scheduled for FY89 connection. At the present time, these two DoD sources represent only 0.7 percent of the flow from point sources into the York River.

Nonpoint Sources. On a regional scale, the DoD installations probably contribute a relatively insignificant loading of nonpoint source conventional pollutant loadings to the York River estuary compared to the surrounding contributions. Based on land surface area, these installations represent approximately 15% of the total York River drainage area. There are no quantitative estimates available for nonpoint source pollutant loadings to this region.

4.9.1.4 Summary of DoD Impacts on the York River Estuary. There are a total of five DoD installations in the York River Estuary (including Back River). They represent eight percent of the total number of installations operating in the Chesapeake Bay drainage basin. Figure 4.14 shows the approximate locations of these DoD installations relative to the Chesapeake Bay. Four of the installations (NSC Yorktown, NWS Yorktown, NSC Cheatham Annex, Langley AFB) were judged during Phase I to represent a poorly defined but likely significant impact potential on water quality and were examined in greater detail during Phase III of this study. The fifth installation, Camp Peary, was judged to represent a poorly defined but likely insignificant impact potential on water quality and was not examined further.

Table 4.31 presents the final screening results for all five DoD installations in the region. Based on a more detailed review and assessment

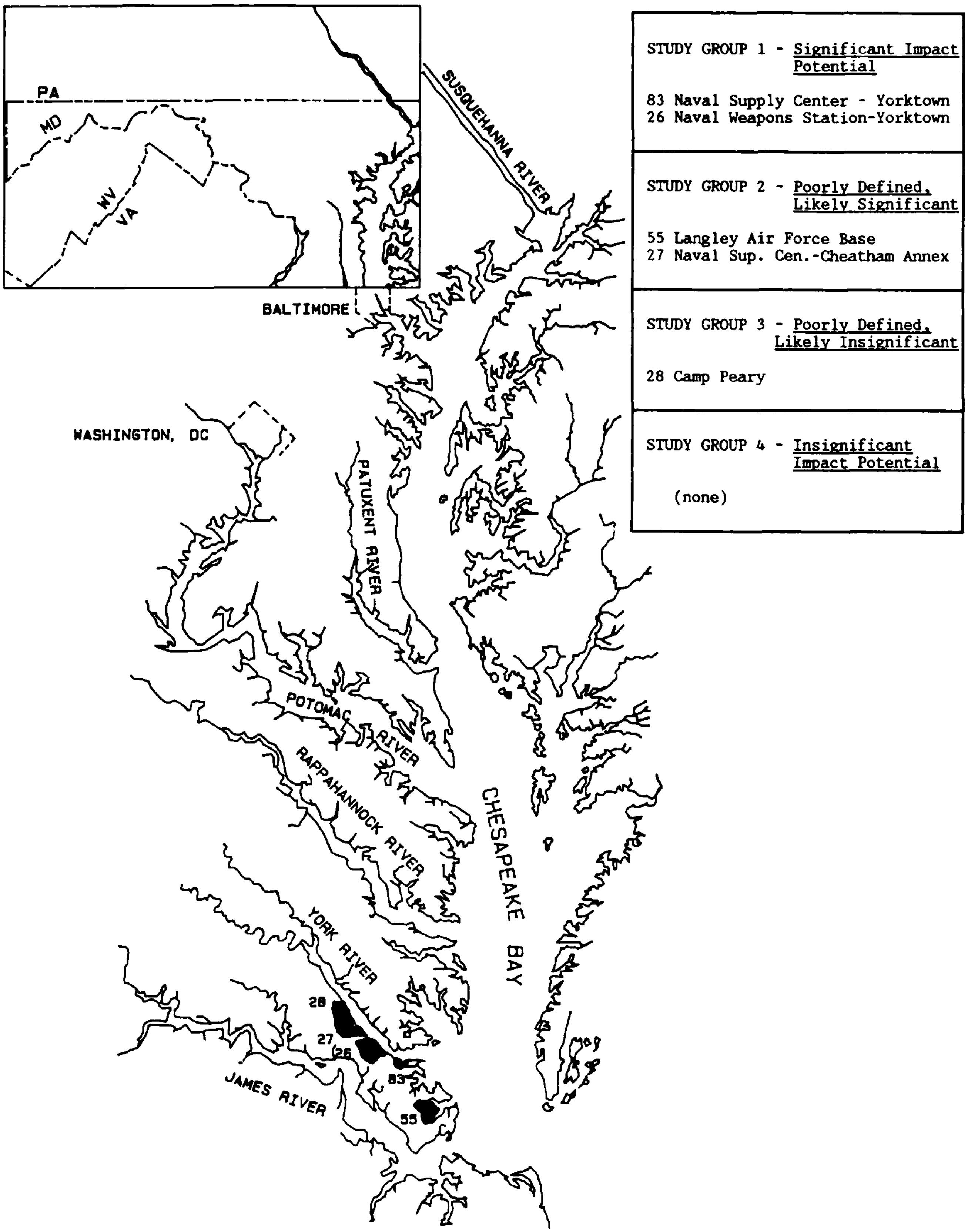


Figure 4.14 Location of DoD Installations in the York River Estuary Region and Summary of Installation Impact Potential.

Table 4.31 Summary of Final Screening for Installations in the York River Estuary Region

ON-SITE SCREENING CRITERIA (ON-SITE IMPACT POTENTIAL)

ID	Branch	Installation Name	1. Erosion/Sedimentation	2. Impervious Area Runoff	3. Combined Storm Drains	4. Shoreline Erosion	5. Sewage Treatment	6. Industrial Waste Treat	7. Intermitt Sewage Treat	8. Refueling Operations	9. Munitions Operations	10. Chemical Operations	11. Pesticides	12. Vehicle Maintenance	13. Ship Maintenance	14. Solid Waste Disposal	15. Hazardous Waste	16. SPCC Status	17. Abandoned Sites	18. LUST Status	19. Forestry Mgmt. Plan	20. Wildlife Mgmt. Plan	21. Soil Conservation Plan	22. Stormwater Mgmt. Plan	23. Wetlands Mgmt. Plan	24. Shoreline Erosion Plan
			NON-POINT SOURCES				POINT SOURCES			HAZARDOUS/TOXIC MATERIALS											ENVIRONMENTAL PROGRAMS					
28	NAVY	Camp Peary	-	·	·	-	+	·	·	·	·	·	·	·	·	-	·	+	·	·	+	·	+	+	+	+
27	NAVY	Naval Sup Ctr-Cht Anx	-	-	·	-	+	·	+	-	·	·	·	·	·	·	·	-	θ	·	+	+	+	+	+	+
83	NAVY	Naval Sup Ctr-Yorktwn	·	·	·	·	·	·	-	-	·	·	·	·	·	·	·	+	θ	θ	·	·	·	θ	θ	·
26	NAVY	Naval Weapons Station	·	·	·	·	·	+	·	+	+	+	·	+	·	-	-	-	θ	-	+	+	+	·	-	·
55	USAF	Langley AFB	+	-	·	+	·	·	-	-	·	·	⊕	-	·	·	·	+	-	-	+	·	+	-	·	+
		Score Totals ·	2	3	5	2	3	4	2	1	4	4	4	3	5	3	4	0	1	2	1	2	1	1	1	2
		Score Totals +	1	0	0	1	2	1	1	1	1	1	0	1	0	0	0	3	0	0	4	2	4	2	2	3
		Score Totals ⊕	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
		Score Totals -	2	2	0	2	0	0	2	3	0	0	0	1	0	2	1	2	1	2	0	0	0	1	1	0
		Score Totals θ	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	0	0	0	1	1	0

VICINITY SCREENING CRITERIA (RELATIONSHIP TO LOCAL ENVIRONMENT) and **STUDY GROUP (IMPACT POTENTIAL)**

ID	Branch	Installation Name	25. Shellfish Areas	26. SAV Areas	27. Fish Spawning Areas	28. Wetlands Areas	29. Waterfowl Nesting	30. Endangered Species	31. Relative Local Impact	1. Significant	2. Poorly Defined, Sig.	3. Poorly Defined, Insig.	4. Insignificant
28	NAVY	Camp Peary	-	-	-	-	-	-	+			X	
27	NAVY	Naval Sup Ctr-Cht Anx	-	-	-	-	-	-	-		X		
83	NAVY	Naval Sup Ctr-Yorktwn	-	-	-	θ	-	·	θ	X			
26	NAVY	Naval Weapons Station	-	-	-	-	-	·	θ	X			
55	USAF	Langley AFB	-	·	·	+	+	·	-		X		
		Total Number of Installations per Study Group								2	2	1	0
		Score Totals ·	0	1	1	0	0	3	0				
		Score Totals +	0	0	0	1	1	0	1				
		Score Totals ⊕	0	0	0	0	0	0	0				
		Score Totals -	5	4	4	3	4	2	2				
		Score Totals θ	0	0	0	1	0	0	2				

KEY:
Impact Category 1: { θ Significant Impact Potential (Adverse); ⊕ Significant Impact Potential (Beneficial)
Impact Category 2: { - Unknown or Poorly Defined Impacts (Adverse); + Unknown or Poorly Defined Impacts (Beneficial)
Impact Category 3: · Insignificant Impact Potential (Adverse or Beneficial)

of conditions at these installations, two (NSC Yorktown, NWS Yorktown) were reassigned to Study Group 1 (Significant Impact Potential). The rationale for their reassignment includes: limited, preliminary data observations of the migration of toxic contaminants from inactive waste disposal or spill sites into local surface waters, with contaminant levels exceeding Federal and State water quality criteria; poorly defined quality of discharges from storm drainage and miscellaneous industrial activities; the existence of leaking underground fuel storage tanks; and deficiencies in hazardous waste storage and handling (NWS-Yorktown). Two installations (NSC-Cheatham Annex and Langley AFB) remain assigned to Study Group 2 (poorly defined, likely significant impact potential). At NSC-Cheatham Annex, areas of concern include the tentative status of findings from the ongoing monitoring of NACIP inactive waste sites, and a severe shoreline erosion problem. At Langley AFB, concerns relate primarily to poorly defined stormwater runoff quality/quantity, existence of occasional fuel spills reaching drainage areas not fully contained, and lack of a stormwater management plan.

The region of influence of the five DoD installations appears to be limited to the immediate vicinity of each installation. Compared to the surrounding point and nonpoint pollutant sources, these installations probably contribute an insignificant loading of conventional pollutants (BOD, nutrients, sediments) to the Chesapeake Bay. Ongoing areas of concern at these installations relate primarily to activities that are difficult to control or regulate (i.e., shoreline erosion, stormwater runoff, and inactive hazardous waste disposal or past spill sites). The most beneficial activities or programs at these installations for pollution control and environmental enhancement include natural resources management (NSC Cheatham Annex and Langley AFB), pesticides/herbicides management (Langley AFB), and deactivation of sewage treatment systems (NWS Yorktown, NSC Cheatham Annex in FY88, Camp Peary in FY89). The following sections summarize findings and recommendations for the five installations in this region.

4.9.2 Installation 26: Naval Weapons Station - Yorktown (NWSY)

4.9.2.1 General. NWSY is located approximately 30 miles northwest of Norfolk, Virginia on a peninsula between the York and James Rivers. The 10,451 acre facility is bounded by the Colonial Williamsburg Parkway and the York River on the north, Virginia State Highway 238 on the east, Interstate 64 on the south, and Kings Creek on the west. The primary mission of NWSY is to receive, store, overhaul, test, modify, explosive load, and accomplish other related work pertaining to ammunition, explosives, expendable ordnance items, and/or weapons and technical ordnance materials.

4.9.2.2 Summary of Impact Potential and Recommended Actions. In Phase I of this study, NWSY was screened in Study Group 2 based on: lack of an NPDES permit for industrial wastewater discharges; hazardous waste management practices; and existence of 15 confirmation sites with the potential for offsite migration of contaminants. The installation assessment methodology was applied to NWSY during Phase III to better define

the likely character and extent of its impact on local receiving waters. As a result of this assessment, NWSY has been reassigned to Study Group 1 because: preliminary water and sediment samples collected in receiving waters adjacent to the confirmation sites exhibited pollutant concentrations exceeding water quality standards indicating possible migration of contamination from these sites; and, occasional industrial wastewater discharge NPDES permit limit excesses. Beneficial activities occurring at NWSY include: the connection of all 61 point source discharges to HRSD sewage treatment system; presence of 400 acres of predominantly high quality marshland on site; and, encouragement of fish and wildlife management, and preservation of 78 percent of the installation in an undeveloped state. Table 4.32 summarizes the areas of concern and recommended actions identified for NWSY.

Recommended actions for NWSY include:

- Continue with confirmation studies at the abandoned hazardous waste disposal sites in accordance with the Navy's Installation Restoration Program and implement remedial actions as recommended by the Navy IRP.

- Provide a metering system for five carbon absorption towers to determine useful life of carbon for replacement and to better control wastewater quality; and,

- Institute a wetlands management plan for this valuable onsite resource.

4.9.3 Installation 27: Naval Supply Center - Cheatham Annex (CAX)

4.9.3.1 General. CAX is located in the northwestern portion of York County, Virginia along the western banks of the York River. The facility, which occupies 1,535 acres, is bounded on the north by Queens Creek, on the west by Colonial Parkway, on the south by King's Creek, and on the east by the York River. Since World War II CAX has served as a bulk and backup stock point for receiving, storing, packing and shipping material under the cognizance of the Naval Supply Center in Norfolk.

4.9.3.2 Summary of Impact Potential and Recommended Actions. In Phase I of this study CAX was screened in Study Group 2, based on: the existence of a severe shoreline erosion problem; potential sewage spills from a pierside holding tank; and possible contaminant migration from several inactive landfills. The installation assessment methodology was applied to CAX during Phase III to better define the likely character and extent of CAX's impact on local receiving waters. As a result of this assessment, CAX remains in Study Group 2. Table 4.33 summarizes the areas of concern and recommended actions identified for CAX. The primary areas of concern include: the status of recently implemented shoreline erosion control measures, and results of ongoing groundwater and surface water sampling to detect contaminant migration from two inactive hazardous waste disposal sites. Preliminary data from one of these sites has indicated trace

Table 4.32 Summary of Areas of Concern and Recommendations for Naval Weapons Station - Yorktown

ACTIVITY/POLLUTANTS OF CONCERN	ONSITE	OFFSITE/VICINITY	RECOMMENDATIONS	ESTIMATED COST
16 Confirmation Sites/chemicals PCBs, ordnance wastewater, oil and grease, sludges, solvents, organics	Contamination of streams, wetlands and ponds on site has been documented based on a limited, preliminary data set.	1986 Step 1A Verification study results indicate pollutant concentrations exceeding water quality standards in the receiving waters adjacent to these sites.	Continue with confirmation studies at the abandoned sites in accordance with the Navy's Installation Restoration Program. Implement remedial actions as recommended by the Navy IRP.	Confirmation Study: $300,000 Remedial Action: Cost unknown
Industrial Water Pre-Treatment Carbon Towers/ordnance wastewater		Violations of pretreatment concentration limit 1 ppm TNT have occurred. This wastewater eventually flows through HRSD system.	Meter flow from carbon towers to indicate when carbon should be replaced.	Plumbing: $20,000

Table 4.33 Summary of Areas of Concern and Recommendations for CAX

ACTIVITY POLLUTANTS OF CONCERN	ONSITE	OFFSITE/VICINITY	RECOMMENDATIONS	EST. COST
Shoreline Erosion - sedimentation	Shoreline along York River is exposed and has severely eroded. Erosion controls have been implemented but their effectiveness is unknown.	York River is class II river with important aquatic resources (oyster, crab, clam harvesting; SAV's, endangered sea turtles, and finfish nursery areas). York River is stressed due to HRSD discharges, industrial discharges, and agricultural/urban runoff. CAX pollutant contributions are expected minor except possibly very local to the installation.	Review shoreline erosion control plan and monitor effectiveness of control measures. Perform erosion control feasibility study if necessary.	<u>Plan update</u>: $20,000 <u>Erosion control measures</u>: $750,000
NACIP confirmation sites - metals, pesticides, oil and grease, phthalate esters.	Preliminary sampling results at two inactive disposal sites indicate groundwater contamination in excess of state criteria. Surface water samples in Pennimen Lake exhibited dimethyl phthalate levels exceeding state criterion. Additional monitoring has been recommended under NACIP program.		Recommendations await results of additional findings from NACIP round 2 sampling for the contaminated sites.	<u>Second round confirmation sampling</u>: $100,000

organics contamination in an onsite lake in excess of state water quality criteria. Overall, CAX's impacts on the water quality in the York River are believed to be minor, in comparison to the surrounding contributions. Beneficial activities at this installation have included implementation of a natural resources management plan, including forestry management, and past efficient operation of the onsite 0.1 MGD sewage treatment plant. An analysis is underway to determine whether CAX will be connected to Hampton Roads Sanitary District sewage trunk lines which would further reduce the installation's effect on the York River. Recommended actions for CAX include:

- o Monitor existing erosion control practices to determine their performance and effectiveness in controlling erosion and, if necessary, perform an erosion control feasibility study; and

- o Recommendations regarding possible remedial actions at the two NACIP inactive waste disposal sites await findings of ongoing monitoring activities.

4.9.4 Installation 28: U.S. Armed Forces Experimental Training Activity - Camp Peary

4.9.4.1 General. Camp Peary is located on 9,247 acres in York County, Virginia. The camp is approximately 3 miles north of Williamsburg and is on the York River. The primary mission of Camp Peary is not known due to security precautions.

4.9.4.2 Summary of Impact Potential and Recommended Actions. The screening data for Camp Peary are presented in Tetra Tech (1986). Based on the screening criteria, Camp Peary was judged to fall within Study Group 3, having a poorly defined but likely insignificant impact potential on water quality and ecological resources of the Chesapeake Bay (see Table 4.31). This judgement was based on the following observations:

a. The shoreline loss due to erosion has been extensive the last five years. The shoreline erosion control plan includes planting of marsh seedlings in fringe areas and on mud flats. Area "A" of the shoreline is protected by gabions and tires and area "B" of the shoreline is protected by gabions and riprap. The program is ongoing and the effectiveness appears to be positive. The long term effectiveness is, however, difficult to predict.

b. The secondary sewage treatment plant with polishing ponds has been in compliance with discharge regulations. The discharge of treated effluent into Carter Creek will be terminated when the camp connects to the Hampton Roads Sewage District which is anticipated in FY89.

c. The onsite sanitary landfill is inspected yearly by state officials and is in compliance with state regulations. Six former landfills at Camp Peary were investigated for migration of pollutants. The contents of the landfills included inert

construction rubble, organic material, bottles, trash drums, auto parts, and plumbing. The sites were found to be non-hazardous and no threat to environmental health.

d. Due to the extreme security at the installation, much information freely given at other installations was considered too sensitive for this project.

Camp Peary is likely to have an insignificant impact potential on the Chesapeake Bay and therefore was not studied further in Phase III of this study. Recommended actions for Camp Peary relate to continued use of BMP's for erosion control, and are summarized in Chapter 5.

4.9.5 Installation 83: Naval Supply Center - Yorktown Fuels Division (NSC-YFD)

4.9.5.1 General. The Naval Supply Center-Yorktown Fuels Division (NSC-YFD) is located two miles southeast of Yorktown, Virginia and about 30 miles northwest of Norfolk, Virginia on a peninsula between the York and James River. The primary mission of the NSC-YFD is the transfer and storage of fuel oils by vessel and tank truck. A pier on the York River is used to receive and issue fuel to government vessels, while the truck loading station is used for issuing fuel to other naval installations. Of the 114 total acres, 100 acres are improved and used for fuel oil storage. The remaining 14 acres are unimproved lands fringing the facility along Wormley Creek, which surrounds the site on three sides.

4.9.5.2 Summary of Impact Potential and Recommended Actions. In Phase I of this study, NSC-YFD was screened in Study Group 2 based on the potential for offside migration of surface or groundwater from 16 recommended confirmation sites and the volume of loading, unloading, and storage of fuel oils at this site surrounded by wetlands. The installation assessment methodology was applied to NSC-YFD during Phase III to better define the likely character and extent of its impact on local receiving waters. As a result of this assessment, NCY-YFD has been reassigned to Study Group 1 because of: presence of constituent release into Wormley Creek based on a limited, preliminary data set; lack of a NPDES permit for the point source discharge; and, proximity of the installation to high quality wetlands, shellfish, and SAV areas. On the positive side, there have been no major accidents involving fuel oils at NSC-YFD in the past 35 years. Table 4.34 summarizes the areas of concern and recommended actions identified for NSC-YFD.

Recommended actions for NSC-YFD include:

- Obtain NPDES permit for the oil/water separator point source discharge. A draft permit was submitted in 1977 but has not been finalized by EPA. The final permit should include metals, PAH's, and fuel constituents in addition to oil & grease at this outfall;

Table 4.34 Summary of Areas of Concern and Recommendations for Yorktown Fuels Division

ACTIVITY/POLLUTANTS OF CONCERN	ONSITE	OFFSITE/VICINITY	RECOMMENDATIONS	EST. COST
Confirmation sites/oil and fuel; heavy metals	NACIP confirmation study (Dames and Moore, 1986) found elevated levels of toluene, xylene, lead, and PAH's. Lead concentrations (15.3 - 82.4 μg/l) exceeded VA state chronic standard of 8.6 μg/l for protection of marine aquatic life.	VSWCB (1986) ranks this reach of York River as a medium priority water body due to shellfish closures, point source violations, and poor water quality.	Proceed with confirmation as outlined in Dames & Moore (1986). Institute wetlands management and stormwater management plans to prevent damage to sensitive offsite environment.	Confirmation study: $200,000 Develop wetlands management plan: $30,000 Develop stormwater management plan: $25,000
Leaking underground storage tanks/oil and fuel	1918 vintage concrete storage tanks may leak product into surrounding ground.	The elevation and location of these tanks with respect to Wormley Creek presents the potential of offsite migration of leaked product or contaminated groundwater.	LUST program should be performed on these and other UST's on site.	$250,000 - $500,000
Oil/Water Separator/Oil & Grease, TSS	This oil water separator handles surface drainage from 60% of the site through a series of ditches and culverts.	This is the site's sole point source discharging into prime wetlands and waters of Wormley Creek.	Obtain NPDES permit for this discharge or proceed with MCON project W371B.	Monitoring: $25,000/year
			MCON Project W371B FY1988 ? planned (currently on hold) construction to transfer discharge from oil/water separator to HRSD; including 0.00 1 MGD septic tank/tile field for sewage. Includes CAX & Camp Peary connection to HRSD, i.e. all North Shore discharges.	$1,500,000 (1984 est.)

- o Perform LUST investigations at 5 of 8 Navy Special Fuel Oil (NSFO) tanks;

- o Continue confirmation study and execute remedial actions as recommended;

- o Provide containment berms for confirmation site 13 to prevent surface water runoff; and,

- o Provide catchments for in/out flow lines passing over Wormley Creek to the York River pier.

4.9.6 Installation 55: Langley Air Force Base (Langley AFB)

4.9.6.1 **General**. Langley AFB is located north of Newport News, Virginia, on Hampton Flat between the Northwest and Southwest Branches of the Back River, a tidal estuary of Chesapeake Bay. The base occupies 3152 acres and is very flat with little or no relief. About half of Langley AFB is covered by airfield runways with support services around the perimeter. It is headquarters for the Tactical Air Command (TAC) and home of the 1st Tactical Fighter Wing which flies F-15 Eagles. The primary mission of Langley AFB is to intercept unidentified incoming planes or other vessels for the purpose of defending U.S. and allied forces.

4.9.6.2 **Summary of Impact Potential and Recommended Actions**. Langley was screened in Study Group 2 in Phase I of this study based on the potential for migration of contaminants from 12 former waste sites to local surface waters, the possibility of spills due to large volume of fuel storage and handling, raw sewage spills into Back River from force main breaks, and the proximity to sensitive shellfish harvesting areas. The installation assessment methodology was applied to Langley AFB during Phase III to better define the likely character and extent of Langley's impact on local receiving waters. As a result of this assessment, Langley AFB remains in Study Group 2. Table 4.35 summarizes the areas of concern and recommended actions identified for Langley AFB. As shown in this table, areas of concern include: potential pollution of surface waters by stormwater runoff carrying heavy metals, fuels, and oils; the source of phenols and oil and grease (O&G) in the Bioenvironmental Engineering Services (BES) surface water samples; and the need for a comprehensive wetlands management program for the 450 acres of valuable wetlands located on installation property. Insufficient data exist in the vicinity of Langley AFB to determine its effects on water quality in Back River. Recommended actions for Langley AFB include:

- o Incorporation of a comprehensive Wetlands Management Program in the Land Management Plan stressing the importance of preserving wetlands in their natural state.

Table 4.35 Summary of Areas of Concern and Recommended Actions for Langley AFB

ACTIVITY/POLLUTANTS OF CONCERN	ONSITE	OFFSITE/VICINITY	RECOMMENDATIONS	ESTIMATED COST
Stormwater runoff / heavy metals, fuels, and oils	BES monitoring results show low DO levels below VSWCB standard; phenols O&G, Cd, and Cr exceed VSWCB standard at some stations on occasional basis.	STORET stations show elevated lead levels in sediment, elevated zinc and copper levels in water, and low DO (naturally occurring) in Brick Kiln Creek and New Market Creek.	Continue surface monitoring program and expand by including bottom sediment sampling. Source of phenols and metals detected in BES sampling should be investigated.	Monitoring: $100,000/year
450 acres of Wetlands within Langley AFB boundaries	Langley's Land Management Plan does not address the sensitive wetlands on base in a comprehensive manner.	Wetlands contribute to productivity of the Bay and act as a buffer zone for intercepting and retaining nutrient loadings from surface runoff, thereby protecting the main body of water in the estuary.	A comprehensive Wetlands Management Program should be incorporated into Langley's Land Management Plan to provide protection to these sensitive tidal marsh areas.	Develop Plan: $40,000
Fuel spills / jet fuel	Fuel spills occasionally reach base drainage ditches and are contained by absorbant booms. On windy days the booms are not always effective.	Sensitive shellfish harvesting areas are located nearby in Back River.	Study feasibility of installing closure devices in drainage canals to more effectively contain spills on windy days. Install closure controls if feasible.	Feasibility Study: $20,000 Closure Controls: $200,000

- Expand the present surface water monitoring program by including bottom sediment samples at the eleven sites now surveyed.

- Closure devices should be added to drainage ditches to more effectively contain spills on windy days.

- Investigate the source of phenols which are present in surface water samples and implement corrective measures.

- Review the IRP Phase II results and implement appropriate remedial measures at past disposal sites.

4.10 REGION 9: JAMES RIVER ESTUARY

4.10.1 Tributary/Regional Description

4.10.1.1 Environmental Setting. The James River drains approximately 25% of Virginia's total area and lies within the Atlantic Coastal Plain Province below the Fall Line. The basin is the largest in the state. The river winds 234 miles from its headwaters near the Virginia-West Virginia state line to the confluence with the Bay at Hampton Roads. As shown in Figures 4.15 and 4.16, the James River estuary is divided into three segments: the upper James Estuary, the lower James estuary, and Hampton Roads/Elizabeth River areas. There are eight DoD installations operating in this region.

Upper James Estuary. The James River reaches the Fall Line at Richmond (see Figure 4.15). This relatively urbanized area in an otherwise forested and agricultural watershed creates an impact on water quality at the head of the estuary. Downstream from Richmond at the confluence with the Appomattox River (about 22 miles) the Hopewell area further impacts the tidal freshwaters with discharges from paper, fertilizer, chemical, and tobacco processing plants. The Hopewell area was the site of the illegal Kepone (a toxic pesticide) discharges of a decade ago, which resulted in the James estuary being closed to commercial finfishing to this day.

In this reach of the James River estuary, the river is very responsive to rainfall events, with flows at Richmond ranging from 350 cfs to 313,000 cfs (average of 7,200 cfs). The general trend in water quality is improving, but present conditions are generally poor. All the pollution parameters: dissolved oxygen, nutrients, metals and organic compounds are of concern in the reach.

Lower James Estuary. In contrast to the industrial character of the shoreline at Hampton Roads, this reach is largely wooded and rural, with some urbanization. This reach of the estuary is approximately two miles wide, but with depths of only 6 to 18 feet. Generally the bottom is sandy, but with finer fractions in some holes. The salinity gradient in the lower James estuary is relatively abrupt. At Hampton Roads, the average Fall salinities are about 20 ppt, yet near Ft. Eustis, which is 25 miles upstream, the salinity is only 10 ppt. Consequently the estuarine habitat is significantly different between these two reaches. Water quality in the

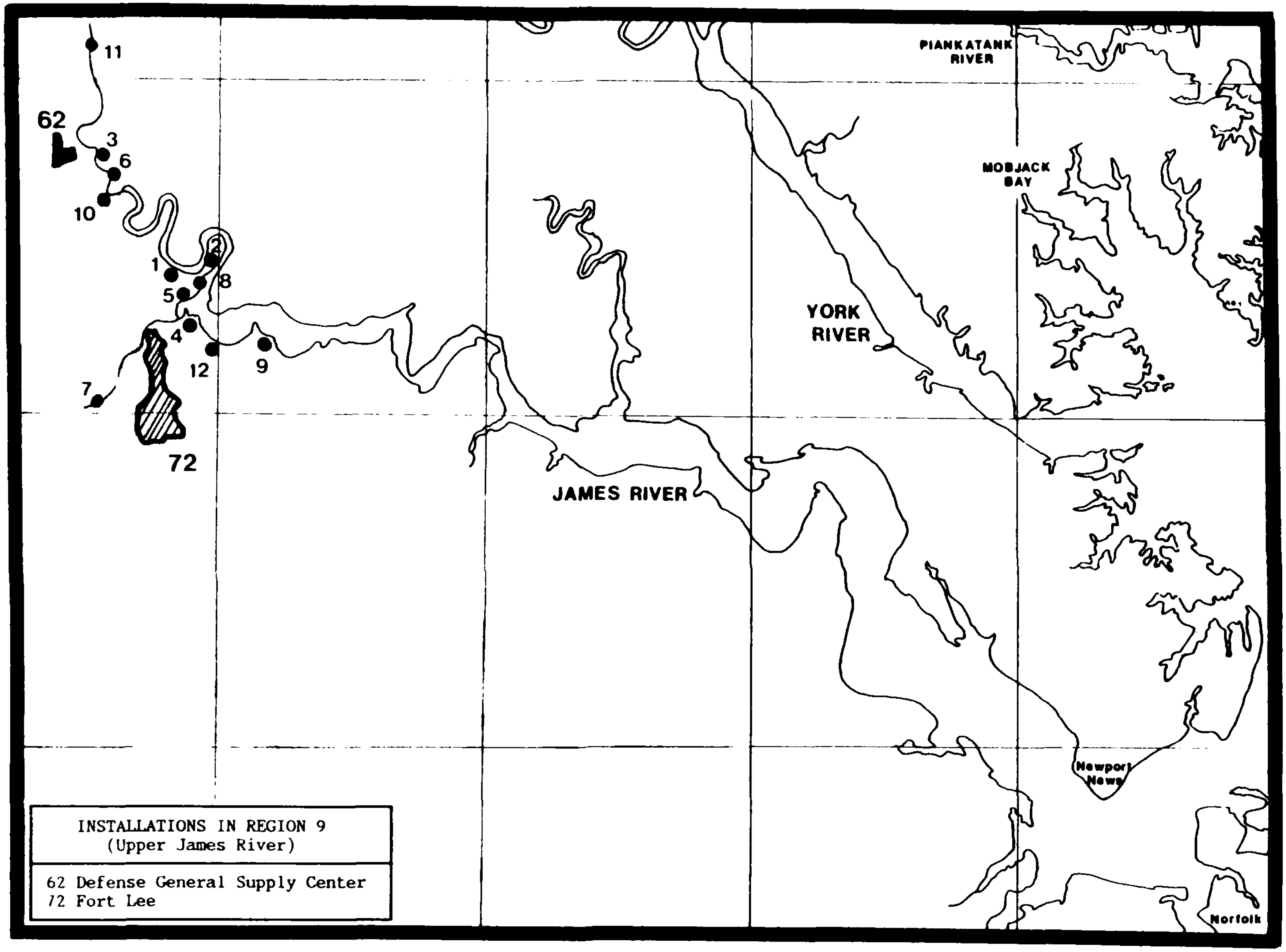


Figure 4.15 Region 9 - James River Estuary (Upper James River)

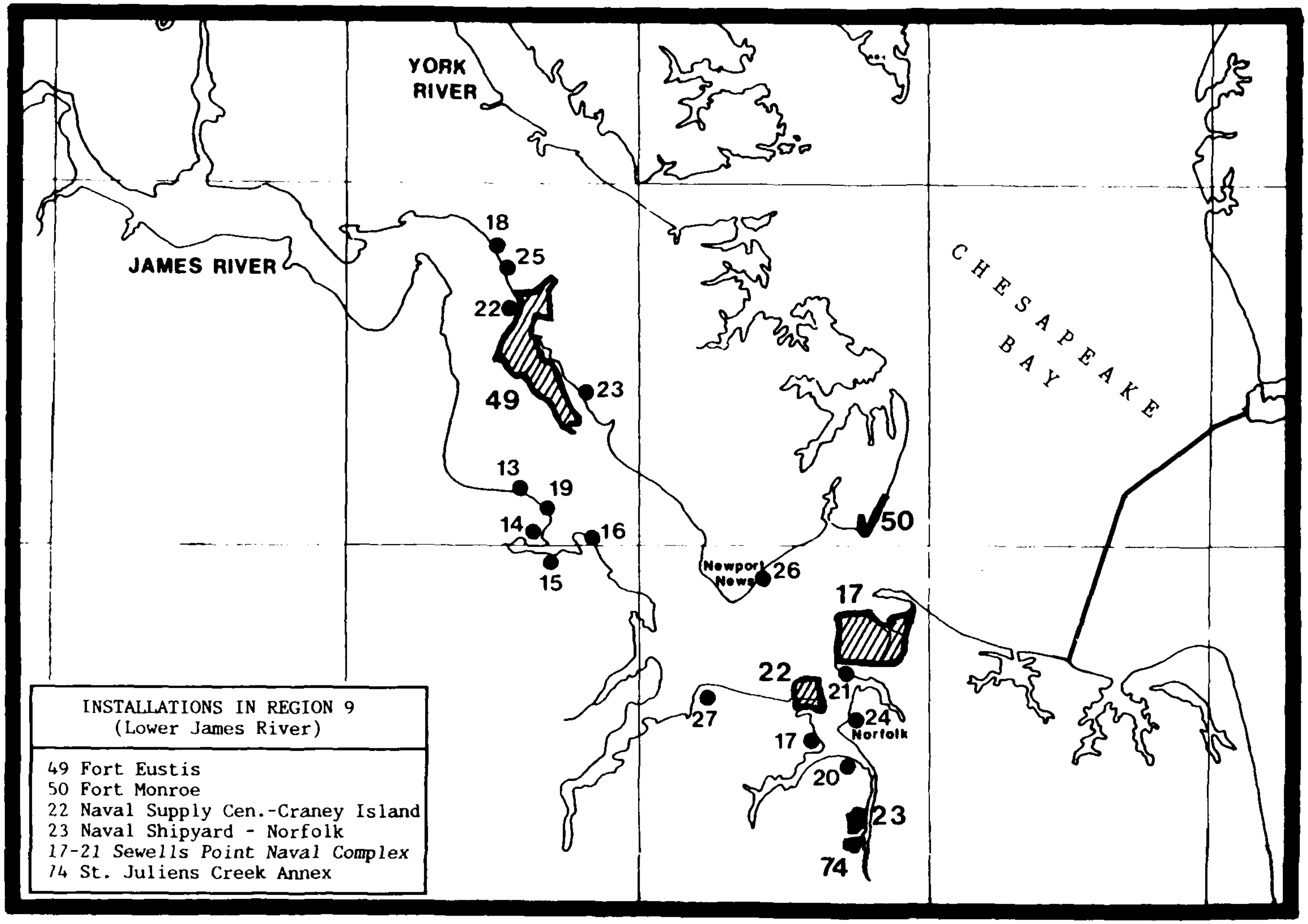


Figure 4.16 Region 9 - James River Estuary (Lower James River)

lower James estuary is generally good, but the waters east of the channel buoys by Fort Eustis are closed to shellfishing. Spring freshets make this reach the upper limit for oysters and soft shell clams. The area is, however, a migratory pathway for the anadromous species, as well as a nursery area. The area is also utilized by some migratory waterfowl, and by many shorebirds. Submerged aquatic vegetation is lacking in this area.

Hampton Roads. This region of the James River estuary includes the mouth of the James, Nansemond, Elizabeth, and Lafayette Rivers (see Figure 4.16). The waters are polyhaline or nearly marine, in character, with salinities ranging seasonally from 14 to 20 ppt. The open expanse of Hampton Roads is ringed with urban, military, and industrial facilities. The Naval Station - Naval Air Station complex is located on the south shore at Norfolk. The Army's Ft. Monroe is located on the north shore, at the confluence with Chesapeake Bay.

In spite of the industrialized shoreline, Hampton Roads supports a viable commercial fishery for finfish, oysters, and hard clams. In addition, the reach serves as a valuable spawning ground for the blue crab. In fact, populations of blue crab throughout the Bay are annually derived from these spawning grounds. A few miles upstream from Hampton Roads are the critical oyster "seed beds" of the James River. These localized areas in the James River consistently spawn extraordinary crops of young oysters or "spat" each year. In the summer, spat are transported throughout the Bay to growing waters, where conditions for growth are more favorable than for reproduction. The seed oyster industry in this area is significant, and is a major factor in the restoration efforts of the stressed Bay oyster population. The area is used moderately by wintering waterfowl. In the warm months, shore birds characteristic of this habitat can be found.

Water quality, as indicated by the traditional parameters of dissolved oxygen, nutrients, suspended solids, and temperature, is generally fair in the Hampton Roads reach. Bottom sediments, however, have exhibited elevated levels of heavy metals and anthropogenic organic compounds, especially in the Elizabeth River tributary.

The Elizabeth River and its branches are tributary to the James River near its mouth at Hampton Roads (see Figure 4.16). The region is heavily urban and industrial and includes abandoned creosote and chemical plants. Little freshwater enters this subestuary, thus the waters are generally polyhaline. While the river is tidal, flushing is minimal, resulting in long residence times for materials discharged into the river. Among the military installations on this subsystem are the Naval Shipyard, Naval Hospital, and St. Juliens Creek Annex. The river channels are dredged to accommodate large ocean-going vessels.

Water quality, especially towards the headwaters of the Elizabeth, is generally poor. Dissolved oxygen deficiencies, elevated nutrient levels, and high bacteriological counts have been reported, as well as high levels of heavy metal contamination and anthropogenic organic compounds. The waters are currently closed to shellfishing.

In spite of the poor water quality, the Elizabeth River still functions as a nursery area for several fish, including menhaden, spot, croaker, weakfish, striped bass, and some river herring species. Recent studies, however, show histopathological problems in fish from the Elizabeth River to include blindness, lesions, gill necrosis, and fin rot.

The locations of the eight DoD installations in this region in relation to the Chesapeake Bay are shown in Figure 4.17.

4.10.1.2 Vicinity Pollutant Loads

Vicinity Point Sources. Municipal and industrial wastewater treatment are major contributors of conventional pollutants to the James River estuary. There are 12 treatment plants (six municipal, six industrial) discharging into the tidal freshwater zone (upper estuary), and 15 treatment plants (nine municipal, six industrial) discharging into the saline zone (lower estuary and Hampton Roads), as shown in Table 4.36 and Figures 4.15 and 4.16. The combined average discharge flow is 326.6 MGD in the tidal freshwater zone, and 94 MGD in the saline zone.

Industrial development in the James River area is extensive and compares with the Baltimore area as one of the Bay's most industrialized river basins. The most notable discharges with respect to water quality are located along the James mainstem in the Richmond area, Bailey Creek in the Hopewell area, and along the Elizabeth River in the Norfolk-Portsmouth area. Industrialized discharges include several power plants, several chemical manufacturing companies, meat packing operations, and paperboard manufacturing. Table 4.37 presents estimates of metals from point sources (municipal and industrial discharges) by county into the James River (EPA, 1982). Table 4.38 presents estimates of loadings of selected metals and toxic constituents from industrial discharges and municipal discharges into the James River (National Wildlife Federation, 1980). These data, although approximate, indicate a relatively substantial potential for the existence of cumulative effects of toxics on the health and productivity of this estuary.

Vicinity Nonpoint Sources. Upland areas represent the greatest source of conventional pollutants, particularly BOD, sediments, and nutrients, to the James River estuary. Nonpoint sources to the James can be separated into three major categories: 1) upstream loadings at the Fall Line; 2) urban runoff from the Newport News-Norfolk areas; and 3) local (below the Fall Line) tributaries to the James River. Estimates of long-term annual average upstream pollutant loadings at the Fall Line (EPA, 1982) are presented below.

(value x 10^3 lbs/day)							
TN	NO_2+NO_3	NH_3+NH_4	TKN	TP	OP	SED	AVERAGE FLOW
29.1	10.3	1.5	17.5	4.5	1.6	2980	6879 cfs

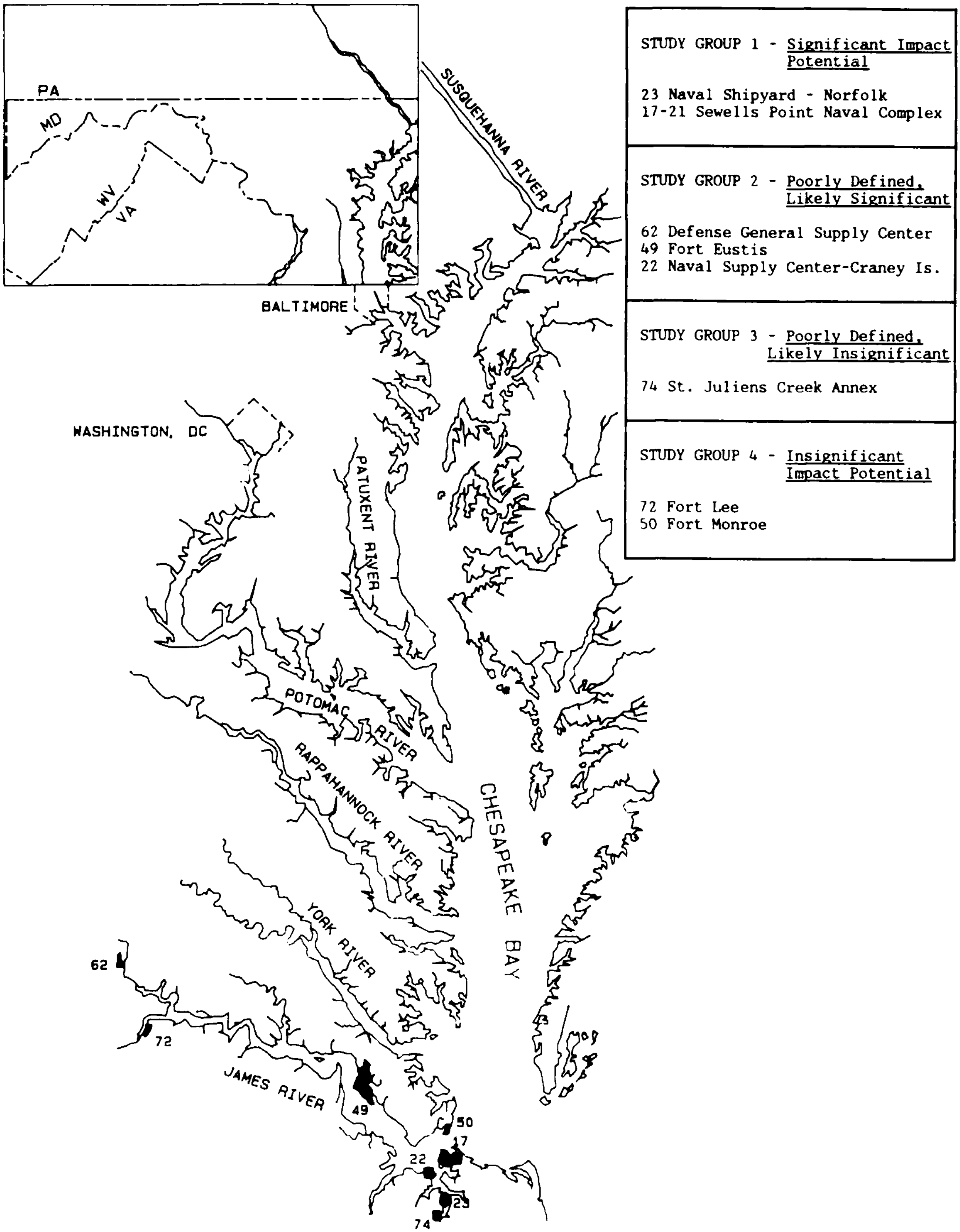


Figure 4.17 Location of DoD Installations in the James River Estuary Region and Summary of Installation Impact Potential.

Table 4.36 Comparison of Point Source Conventional Pollutant Loadings to the James River Estuary*

CODE	NPDES	NAME	BOD_5	NH_3	TKN	TN	PO_4	TP	TSS	FLOW (MGD)
			LOADING (lbs/Day)							
1	2780	The American Tabacco Co.	102	-	-	-	-	-	82	1.3
2	3077	ICI Americas	11.5	-	-	-	-	-	8.5	0.06
3	4669	EI Dupont	204	-	354	354	-	-	13.6	9.47
4	5291	Allied Chem Corp. Hopewell	1144	5186	-	5185	-	-	933	157.8
5	5312	Allied Chem Corp. Chesterf.	269	27	-	27	-	4	0	40.6
6	24996	Chesterfield - Falling Creek	664	972	1185	1332	275	461	458	8.6
7	25437	Petersburg STP	2012	1291	1590	1810	491	662	3034	8.2
8	26557	Philip Morris	71	6.5	59	59	-	-	36	1.37
9	31755	Rivers Edge Subd.	4.6	1.7	2.3	2.4	0.6	0.9	6.2	0.01
10	60194	Proctors Creek STP	315	85	311	367	170	198	110	3.4
11	63177	Richmond Div. of WT	6749	4377	5353	5996	1713	2034	3359	64.2
12	66630	Hopewell STP	6302	4811	5195	6590	83	185	12488	31.6
		Total Tidal Freshwater Zone	17849	16757	14049	21724	2733	3546	20529	326.6
13	2844	ITT Gwaltney	108	139	139	139	-	-	-	1.25
14	2852	Smithfield Ham & Products	0.4	0.5	0.5	0.5	-	-	-	0.01
15	2879	Smithfield Packing	121	156	156	156	-	-	-	1.4
16	3263	J. H. Miles & Co.	6563	-	-	-	-	-	-	0.64
17	3387	Virginia Chemicals	246	-	-	-	-	-	-	0.62
18	3654	DOW Badische	92	-	-	-	-	-	192	4.18
19	23809	Smithfield, Town of	31	45	55	62	13	24	37	0.4
20	25003	Portsmouth City - Pinners Point	13679	1102	1606	1644	278	556	4463	9.25
21	25208	Army Base WPCF	360	1981	2266	2281	385	465	901	13.51
22	25216	Ft. Eustis	113	190	232	260	77	90	208	1.69
23	25241	HRSD - James River	363	1069	1183	1480	496	565	818	9.84
24	25259	HRSD - Lamberts Point	15465	2636	3294	3319	348	616	6903	18.41
25	25267	HRSD - Williamsburg	516	108	347	1464	222	328	944	10.04
26	25283	HRSD - Boat Harbor	1353	2365	2882	2943	650	822	2328	16.24
27	64459	Nansemond	410	241	484	1068	319	386	434	5.03
		Total Saline Zone	39420	10033	12645	14817	2788	3852	17228	93.51

*Based on Summer 1984/1985 conditions reported by USEPA (J. Macknis, Personal Communication)

Table 4.37 ESTIMATED LOADINGS OF METALS TO JAMES RIVER ESTUARY (METRIC TONS/YEAR)*

County	Cr	Cd	Pb	Cu	Zn	Fe	Mn	Ni
				Point Sources				
Richmond City	23.7	1.1	9.8	23.4	37.2	67.1	-	-
Henrico	1.1	0.0	0.4	0.2	1.9	0.0	-	-
Chesterfield	12.1	0.2	18.3	5.2	5.7	7.6	-	-
Hopewell City	22.2	0.6	7.6	8.3	33.6	43.3	-	-
Williamsburg City	2.4	0.1	0.7	1.1	3.2	6.8	-	-
Newport News City	22.4	4.2	6.9	19.9	26.7	74.8	-	-
Norfolk City	18.7	1.3	5.8	10.8	24.6	55.4	-	-
Portsmouth City	19.6	6.0	4.8	23.3	21.9	15.5	-	-
Subtotal	122.2	13.5	54.3	92.2	154.8	270.5	-	-
				Nonpoint Sources				
atmospheric	-	0.2	1.8	1.5	43	4.5	1.2	1.3
urban runoff	4	1	26	2	15	213	3	4
upstream at Fall Line	63	6	31	41	205	567	2277	64
Subtotal	67	7.2	58.8	44.5	343.0	784.5	2281.2	69.3
TOTAL	189	21	113	137	498	1055	2281	69

* EPA (1982)

Table 4.38 **Estimates of Loadings of Selected Metals and Toxics from Industrial and Municipal Discharges into the James River***

	lbs/day
Aluminum	1722.0
Antimony	819.0
Beryllium	17.5
Chromium	329.5
Copper	34.5
Cobalt	11.0
Cadmium	10.5
Lead	16.8
Mercury	10.0
Nickel	61.5
Thallium	53.0
Tin	14.0
Titanium	95.0
Selenium	0.4
Vanadium	13.0
Zinc	583.0
Oil & Grease	3951.0
PAH[3]	26.0
Phenols	237.0
Phenolics	100.0
Ethylbenzene	56.5
Bis (2-ethylhexyl)	31.0
Hydroxylamine	1.0
Trichloroethylene	9.0
Pentachlorophenol	17.5
Tetrachloroethylene	188.0
1,1,1,-trichloroethane	138.6

* National Wildlife Federation (1980)

No similar estimates are available for pollutant loadings from urban runoff or from the local tributaries below the Fall Line.

Nonpoint sources of metals to the James River estuary include atmospheric deposition, urban runoff, and upstream loadings at the Fall Line. Table 4.37 presents estimates of metals loadings from nonpoint sources to the James River estuary (EPA, 1982). There currently are no similar estimates of nonpoint source loadings of toxics to the estuary.

4.10.1.3 Relative Comparison to DoD Installation Pollutant Loads.

Point Sources. Seven of the eight DoD installations operating in the James River Estuary have sanitary wastewater treated by the respective municipal treatment systems. The one exception is Fort Eustis, which operates a 3.0 MGD (design flow) secondary STP (see Table 4.36). The Sewells Point Navy Complex sends approximately 4.0 MGD sanitary wastewater and 1.0 MGD ship-to-shore and industrial wastewater to Hampton Roads Sanitary District. The only other wastewater discharges include an oily-water treatment system at NSC Craney Island, and an industrial wastewater treatment system at Norfolk Naval Shipyard. The latter treatment system is scheduled to be shut down and connected to the Portsmouth City treatment system. Several of the installations have NPDES permits for storm drains and minor industrial drains (DGSC, Fort Eustis, Sewells Point, NSC Craney Island, and Norfolk Naval Shipyard). In general, these discharges are in compliance with permit limits except during storm events, when typically the oil/water separators (if they exist) cannot handle the high flow rates. In the case of Sewells Point, an examination of one full year of discharge monitoring data resulted in the finding that a rather high dry weather flow rate was occurring in several of the storm drains. Assuming average flow rates and using the reported average metals and oil and grease concentrations resulted in relatively large estimated loadings of these pollutants to the James River from Sewells Point. Other than these discharges (which yet remain poorly characterized) the point source loadings from DoD installations in the James River Estuary are insignificant compared to the surrounding industrial and municipal point sources.

Nonpoint Sources. On a regional scale, the eight DoD installations contribute a relatively insignificant loading of nonpoint source conventional pollutants to the James River Estuary. Based on land surface area, the DoD installations represent less than two percent of the total James River drainage area (including the areas above and below the Fall Line). In the Elizabeth River subdrainage area, the ratio of DoD surface area is larger (about 5%), but in comparison, DoD installation nonpoint sources are still likely to be minor in comparison to the surrounding extensive urban and suburban land contributions. Because of the generally poor water quality conditions in the Elizabeth River system, however, and the inability of this system to readily flush itself by tidal action or by stream flow, management and reduction of point and nonpoint source pollutants is especially important.

4.10.1.4 Summary of DoD Impacts on the James River Estuary. The eight DoD installations in this region (see Figure 4.17) represent 13 percent of the total number of installations operating in the Chesapeake Bay drainage basin. Of these eight installations, three (Fort Lee, Fort Monroe, and St. Juliens Creek Annex) were estimated during Phase I of the study to represent a likely insignificant potential for water quality impacts. The remaining five installations were estimated to represent a likely significant potential for water quality impacts by virtue of their activities, and were examined in greater detail during Phases II and III of this study.

Table 4.39 presents the results of the final screening of all eight DoD installations. Two of the installations (Sewells Point Navy Complex, Naval Shipyard Norfolk) were judged to represent a significant adverse impact potential on local water quality conditions. Areas of concern include:

- Preliminary evidence of the migration of toxic contaminants from inactive waste disposal or past spill sites into local surface waters, with contaminant levels exceeding Federal and State criteria;

- Poorly defined quality of discharges from storm drainage and miscellaneous industrial activities;

- Introduction of pollutants from ship maintenance activities; and

- The existence of leaking underground fuel storage tanks.

Three of the installations (Defense General Supply Center, Fort Eustis, and Naval Supply Center-Craney Island) were estimated to represent a poorly defined but likely significant impact potential. Areas of concern for these three installations are similar to the previously listed concerns (contaminant migration, stormwater runoff, and fuel leakage/spills). In general, there is a lack of adequate data to quantify pollutant sources and the potential impact levels from these activities. The remaining three installations (Fort Lee, Fort Monroe, St. Julien's Creek Annex) were estimated to represent an insignificant potential for water quality impacts, based on the available information.

The region of influence of the DoD installations appears to be limited to the immediate vicinity of each installation, since there are no major point sources at any of these facilities. A possible exception to this is the apparently significant dry weather loading of pollutants (metals, oil and grease) from Sewells Point. The current estimates for these loadings are, however, in question. The most beneficial programs at DoD installations in this region for pollution control and environmental enhancement have included elimination of industrial discharges by connection to regional sewer systems (Sewells Point) with similar plans at NSC Craney Island and Norfolk Naval Shipyard, implementation of effluent toxics monitoring programs (Sewells Point, Fort Eustis), and implementing upgrades to sanitary and industrial waste water treatment systems (Fort Eustis, Craney Island, Naval Shipyard Norfolk).

Table 4.39 Summary of Final Screening for Installations in the James River Estuary Region

			ON-SITE SCREENING CRITERIA (ON-SITE IMPACT POTENTIAL): NON-POINT SOURCES				POINT SOURCES			HAZARDOUS/TOXIC MATERIALS											ENVIRONMENTAL PROGRAMS						VICINITY SCREENING CRITERIA: RELATIONSHIP TO LOCAL ENVIRONMENT							STUDY GROUP: IMPACT POTENTIAL			
ID	Branch	Installation Name	1. Erosion/Sedimentation	2. Impervious Area Runoff	3. Combined Storm Drains	4. Shoreline Erosion	5. Sewage Treatment	6. Industrial Waste Treat	7. Intermitt Sewage Treat	8. Refueling Operations	9. Munitions Operations	10. Chemical Operations	11. Pesticides	12. Vehicle Maintenance	13. Ship Maintenance	14. Solid Waste Disposal	15. Hazardous Waste	16. SPCC Status	17. Abandoned Sites	18. LUST Status	19. Forestry Mgmt. Plan	20. Wildlife Mgmt. Plan	21. Soil Conservation Plan	22. Stormwater Mgmt. Plan	23. Wetlands Mgmt. Plan	24. Shoreline Erosion Plan	25. Shellfish Areas	26. SAV Areas	27. Fish Spawning Areas	28. Wetlands Areas	29. Waterfowl Nesting	30. Endangered Species	31. Relative Local Impact	1. Significant	2. Poorly Defined, Sig.	3. Poorly Defined, Insig.	4. Insignificant
62	DLA	Defense Gen Sup Ctr.	·	-	·	·	·	·	·	-	·	-	·	-	·	·	-	·	Θ	+	·	·	·	-	·	·	·	·	·	·	·	·	-		X		
72	ARMY	Fort Lee	·	·	·	·	·	·	+	-	·	·	⊕	·	·	+	·	+	·	·	+	·	+	+	·	·	·	·	·	·	·	·	+				X
49	ARMY	Fort Eustis	·	·	·	·	-	-	·	-	·	·	·	-	-	Θ	-	·	Θ	-	+	+	·	·	+	·	Θ	·	·	⊕	⊕	·	-		X		
50	ARMY	Fort Monroe	·	·	-	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	+	·	·	·	+	·	·	·				X
17	NAVY	Sewells Pt Navy Compx	·	Θ	Θ	·	·	+	·	Θ	·	-	·	-	Θ	·	-	-	-	-	·	·	·	-	·	·	-	·	-	·	·	·	-	X			
22	NAVY	NSC - Craney Island	·	·	·	+	·	⊕	·	-	·	·	·	·	·	-	-	-	Θ	Θ	+	-	·	Θ	-	+	Θ	·	-	-	-	·	-		X		
23	NAVY	Nav. Shipyard-Norfolk	·	-	·	·	·	Θ	·	·	·	Θ	·	·	Θ	Θ	Θ	-	Θ	-	·	·	·	-	-	·	·	·	-	Θ	·	·	Θ	X			
74	NAVY	St. Juliens Cr. Annex	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	-	·	·	·	·	·	+	·	·	·	-	-	·	·	·			X	
		Total Number of Installations per Study Group																																2	3	1	2
Score Totals		·	8	5	6	7	7	4	7	3	8	5	7	5	5	4	3	4	2	3	5	6	7	3	3	6	5	8	4	3	6	8	2				
		+	0	0	0	1	0	1	1	0	0	0	0	0	0	1	0	1	0	1	3	1	1	1	3	2	0	0	0	1	1	0	1				
		⊕	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0				
		-	0	2	1	0	1	1	0	4	0	2	0	3	1	1	4	3	2	3	0	1	0	3	2	0	1	0	4	2	1	0	4				
		Θ	0	1	1	0	0	1	0	1	0	1	0	0	2	2	1	0	4	1	0	0	0	1	0	0	2	0	0	1	0	0	1				

KEY: Impact Category 1: { Θ Significant Impact Potential (Adverse)
⊕ Significant Impact Potential (Beneficial)

Impact Category 2: { - Unknown or Poorly Defined Impacts (Adverse)
\+ Unknown or Poorly Defined Impacts (Beneficial)

Impact Category 3: · Insignificant Impact Potential (Adverse or Beneficial)

Ongoing areas of concern at DoD installations in this region relate primarily to activities that are difficult to control or regulate. They include: stormwater runoff; dispersed intermittent sources of industrial (toxic) pollutants to sewage treatment systems and/or to storm drains; and inactive hazardous waste disposal or past spill sites. The following sections summarize findings and recommendations for the eight installations in this region.

4.10.2 Installation 62: Defense General Supply Center, Richmond (DGSC)

4.10.2.1 General. DGSC is a 638 acre installation located in Chesterfield County about two miles south of Richmond, Virginia, overlooking the James River (see Figure 4.15). Surface drainage is collected by a storm sewer system which discharges to Kingsland Creek and to two unnamed creeks, one of which flows to Falling Creek. All surface runoff eventually reaches the James River. The base is highly developed with a large percentage of its surface area being impervious. The primary mission of DGSC, the only Defense Logistics Agency (DLA) facility addressed in this study, is the storage and distribution of supplies to DoD installations. There are few industrial operations at DGSC other than a metal combat helmet refurbishing shop which strips and repaints helmets. The Virginia Army National Guard is a tenant organization and has a motor pool and storage area on base.

4.10.2.2 Summary of Impact Potential and Recommended Actions. DGSC was screened in Study Group 2 in Phase I of this study based on: the confirmation of contaminants migrating offsite from a former landfill; potential migration of contaminants from a former fire training area; detection of oil and grease in surface water runoff; and open storage of 55 gallon drums of POL products which have a history of leakage problems. The installation assessment methodology was applied to DGSC during Phase III to better define the likely character and extent of the installation's impact on local receiving waters. As a result of this assessment, DGSC remains in Study Group 2. Table 4.40 summarizes the areas of concern and recommended actions identified for DGSC. As shown in this table, areas of concern include: potential migration from the Area 50 Landfill; potential migration from the Open Storage Area; the Fire Training Area being placed on the EPA Superfund National Priority List; stormwater runoff with potential for carrying urban washoff to surface waters; and the high turnover rate of environmental staff in DGSC's Environmental Protection Office. It is not possible to determine the effects of DGSC on local receiving waters due to lack of proper surface water quality data in the vicinity. Recommended actions for DGSC include:

- o Additional monitoring in and around the stormwater sewer system that passes under the Area 50 and the OSA sites to determine whether contaminants are migrating off base via the storm sewer.

- o Establish a surface water sampling program for all surface drainage waters on DGSC. Constituents to be analyzed in Kingsland

Table 4.40 Summary of Areas of Concern and Recommendations for Defense General Supply Center.

Activity/Pollutants of Concern	Onsite	Offsite / Vicinity	Recommendations	Estimated Cost
Area 50 Landfill / unknown chemical waste disposal	Virginia drinking water standards (DWS) exceeded for phenol, Cd, and Cr. Contamination appears confined to the installation but migration possible via storm sewer.	Migration of contaminants off base possible via storm sewer. No VAWCB data for metals in Kingsland Creek. Falling Creek stations show very slight elevations of metals.	Additional monitoring within and around the storm sewer that runs under Area 50 is recommended to determine whether contaminants are migrating off site.	Monitoring: $30,000/year
Open Storage Area / fuels, oils, and semi-volatiles	The area shows evidence of past fuel spills. Groundwater contamination is potentially migrating from the site.	No data exist to verify whether contaminants from this site are reaching surface waters of Falling creek or Kingsland Creek.	The surface water monitoring program for Kingsland Creek should be continued and also expanded to include other surface drainage waters.	Monitoring: $50,000/year Covered Storage Area: $530,000 (planned)
Fire Training Area / petroleum hydrocarbons, pesticides, volatiles, semi-volatiles / EPA Superfund National Priority List	The site has potential for leaching contaminants to Kingsland Creek. Phenols in ground water exceed VA Ground Water Standards.	No surface water quality data are available to determine if pollutants are reaching Kingsland Creek. Ground water direction of flow is toward Kingsland Creek.	Continue surface water sampling in Kingsland Creek and include contaminants reported in Phase II study for this confirmation site.	Monitoring: $50,000 Isolation: $200,000 Cleanup: $1,000,000
Stormwater Runoff / oil-water separators / NPDES permit	High percentage of installation is impervious surface and urban-type stormwater quality problems may exist.	Slightly elevated levels of metals have been detected in Falling Creek, but no data exist for Kingsland Creek.	Institute a wet weather storm water runoff monitoring program at all DGSC outfalls. Also investigate need for NPDES permit at oil/water separators.	Monitoring: $50,000/year Study: $40,000
High turnover rate of personnel in Environmental Protection Office	Environmental programs at DGSC are frustrated by frequent turnover of EPO personnel.	Lack of well-trained environmental people on site may increase potential for DGSC to impact local receiving waters due to lack of adequate environmental protection.	DGSC should conduct internal investigation to determine cause of high turnover rates and restaff EPO office as soon as possible.	Costs unknown

Creek should coincide with contaminants reported in Phase II study for the Fire Training Area (petroleum products, pesticides, etc.).

- o Establish a wet weather stormwater monitoring program at all DGSC outfalls to determine need for stormwater management controls.
- o Investigate the need for NPDES permits for oil/water separators.
- o Investigate reasons for high turnover rate of personnel in Environmental Protection Office.

4.10.3 Installation 72: Fort Lee (FTL)

4.10.3.1 General. FTL is located in Prince George's County, Virginia, approximately equidistant between Petersburg and Hopewell (see Figure 4.15). The installation covers a total of 5,430 acres and drains into the Appomattox River, a tributary of the James River. The primary mission of FTL is the command of the U.S. Army Quartermaster School and includes training, administrative, and logistics facilities.

4.10.3.2 Summary of Impact Potential and Recommended Actions. The screening data for FTL are summarized in Tetra Tech (1986). Based on the screening criteria, FTL was screened in Study Group 4, having an insignificant impact potential on water quality and ecological resources of the Chesapeake Bay (see Table 4.39). Major considerations for this judgement include the following:

a. FTL has corrected a previous erosion problem along the Appomattox River through implementation of an effective shoreline erosion control plan and includes riprap along the river bank. This area has been graveled for use as a water treatment operator training site;

b. FTL has recently finished a $200,000 Pest Management Shop for storage and handling of pesticides in a conforming area. A recent study found low levels of pesticides in the rinse water;

c. FTL has implemented spill containment and control measures at the POL training area. The training areas have been bermed and oil/water separators have been installed to decrease the potential for a spill to reach a major tributary; and

d. FTL has started a $2.5 million project to cap and monitor an abandoned landfill located on the banks of the Appomattox River. Steep slopes and highly erodible soils in the landfill area have created a potential problem of landfill pollutant migration.

FTL has alleviated many potential problems and was not examined further in Phase III of this study. There are no recommended actions for FTL.

4.10.4 Installation 49: Fort Eustis

4.10.4.1 **General**. Fort Eustis is a TRADOC installation in Newport News, Virginia (see Figure 4.16). The installation drains into the James River. The primary mission of the installation is the training of Army personnel in the various fields of transportation services. Training ranges from passenger vehicle and heavy truck driving to loading and transfer of cargo. Fort Eustis is the Army transportation center and provides support for all of the Army's Logistics Over the Shore (LOTS) training which includes the loading and unloading of transport ships. A ship loading and unloading area is kept dredged and is called the "third port area". Fort Eustis is the parent installation of Fort Story where LOTS training actually takes place.

Fort Eustis is a large installation, although most of the installation is comprised of tidal salt marsh and is unsuitable for training. The few areas which are available for training are higher and well-drained.

4.10.4.2 **Summary of Impact Potential and Recommended Actions**. In Phase I of this study, Fort Eustis was screened in Study Group 2, based on the potential for contaminant migration from an active landfill into local surface waters, and the possible existence of toxics in the sewage treatment plant effluent. The installation assessment methodology was applied to Fort Eustis during Phase II as a test to better define the likely character and extent of Fort Eustis' impact on local receiving waters. As a result of this test assessment, Fort Eustis remains in Study Group 2. Table 4.41 summarizes the areas of concern and recommended actions identified for Fort Eustis. As shown in this table, areas of concern include: status of findings from the STP effluent toxics monitoring program; status of the NPDES permit for the two oil/water separators; and potential contaminant migration from the active landfill into an adjacent tidal creek. Existing water quality data for this installation are inadequate to determine the level of impacts, if any, from the above pollutant sources. Fort Eustis has an aggressive non-disturbance policy for the wetlands on base, which is a significant beneficial effect due to the large areas of wetlands that exist along the James River. Recommended actions for Fort Eustis include:

- Examine DMR data for the STP, plus results of the effluent toxics monitoring program to evaluate STP compliance and need for control/elimination of industrial discharge or pre-treatment requirements;

- Continue monitoring leachate migration from the landfills. A feasibility study for possible migration of metals contamination into Bailey's Creek and the Warwick River should be undertaken, if monitoring results indicate high contaminant levels;

- Perform additional monitoring of the sand pool discharges to determine need for dechlorinators;

Table 4.41 Summary of Areas of Concern and Recommended Actions
for Fort Eustis

ACTIVITY/POLLUTANTS OF CONCERN	ONSITE	OFFSITE/VICINITY	RECOMMENDATIONS	EST. COST
STP - possible heavy metals in STP sludge	State of Virginia detected elevated heavy metals concentrations in STP sludge. Suspect several minor industrial operations. AEHA developed toxics monitoring program for STP.	No data available.	Continue toxics monitoring program, isolate and control industrial discharges to sewer system.	Monitoring: $30,000/year Pretreatment Analysis: $60,000
Unpermitted oil/water separators - oil and grease, TSS, metals	AEHA measured high TSS levels (low oil and grease) in unpermitted o/w separators (2)	No data available.	Monitor oil/water separators and obtain NPDES permit. Determine need for o/w separator upgrades.	Monitor: $20,000/year Upgrade, if necessary: $20,000/separator
Chlorine in sand pool discharges	AEHA measured chlorine levels 0.2 to 1.0 mg/l in discharges to Warwick River and Eustis Lake	Dilution levels unknown in receiving waters. State standard is: 0.013 mg/l (1 hour average); 0.0075 mg/l (daily average) at 5 ppt.	Monitor total residual chlorine and if necessary, install dechlorination process	Monitor: $20,000 Dechlorination: $100,000
Dredge spoil, unlined fuel oil sludge holding pond, inactive landfills - meals, organics, pesticides, oil and grease, PCBs	Several onsite disposal areas suspected of potential contaminant release. IRP study recommended monitoring of sites.	Limited data available. VASWCB observed elevated metals in water and sediments of Warwick River.	Monitor runoff and sediments in vicinity of disposal sites.	Develop plan: $30,000 Monitor: $100,000 (one time event)
Active landfill - heavy metals, pesticides, organics, PCBs, oil and grease	USATHAMA detected elevated levels of these contaminants downstream of active landfill in Bailey's Creek.	Heavy metals observed by VASWCB in Skiffer Creek upstream of Ft. Eustis. Other pollutant sources in existence.	Continue monitoring leachate migration from landfill. Feasibility study for mitigation, remedial action to control landfill leachate	Monitoring: $50,000/year Study: $50,000 Remedial Action: Cost unknown; likely high

- Check status of the NPDES permit applications for the oil/water separators and determine the need for possible upgrades or routing to the STP; and

- Develop monitoring program to detect possible migration of hydrocarbons from the unlined fuel oil sludge pond.

4.10.5 Installation 50: Fort Monroe

4.10.5.1 General. Fort Monroe is the headquarters installation for the U.S. Army Training and Doctrine Command (TRADOC) (see Figure 4.16). Fort Monroe drains into the Chesapeake Bay. Its primary mission is the administrative support of the headquarters. Fort Monroe is a national historic site with a long tradition. As such, the fort enjoys high visibility from tourism and is kept in excellent repair. The fort has many archeological sites which are well identified. Remote to the fort is Big Bethel reservoir which is maintained as a freshwater source.

4.10.5.2 Summary of Impact Potential and Recommended Actions. The screening data for Fort Monroe are summarized in Tetra Tech (1986). Fort Monroe has no hazardous waste generating industry. Sewage is pumped off-site via a force main crossing Mill Creek to a Hampton Roads Sanitation District facility and solid waste is removed by dumpster under contract. The installation has few environmental hazards especially in light of the ambient water quality of Hampton Roads. Additional findings include:

a. The present condition of the force main which carries all sewage to HRSD is questionable. A break in this main where it crosses Mill Creek would pump large amounts of raw sewage into the local waters. Failure of the main would require discharge of raw sewage directly into Hampton Roads via a bypass line.

b. The installation pumping station is kept in immaculate condition but the low elevation of the installation can cause high water table and flood problems so that the pumps could be overloaded and bypass necessitated during times of unusually high water.

The environmental impact potential of Fort Monroe is estimated to be minor which places the installation into Study Group 4 (insignificant). This installation was excluded from further detailed study in Phase III (see also Table 4.39). A recommended action for Fort Monroe relates to providing adequate protection against accidental leakage from sewage lines, and is summarized in Chapter 5.

4.10.6 Installations 17, 18, 19, 20, 21: Sewells Point Naval Complex

4.10.6.1 General. Sewells Point Naval Complex (SPNC), also known as Naval Base Norfolk, is located at the confluence of the James and Elizabeth Rivers and is bounded on the north by Willoughby Bay (see Figure 4.16). The installation occupies 4,631 acres in the City of Norfolk and is drained by

Mason and Boush Creeks and an extensive stormwater sewer system. SPNC is the largest Navy port and includes about 170 shore based operations and tenant organizations. Five major facilities at SPNC have been identified as being capable of impacting water quality: Naval Air Rework Facility (NARF), Public Works Center (PWC), Naval Air Station (NAS), Naval Station (NAVSTA), and Naval Supply Center (NSC). SPNC employs more than 90,000 people with the actual number of residents and workforce fluctuating greatly depending upon the ships that are in port and the size of their crews. NARF, which is the largest industrial operation at SPNC, has a primary mission of repair and refinishing of Naval aircraft including the overhaul of all aircraft systems. NARF produces a large amount of industrial wastewater which is treated in an advanced industrial waste treatment plant (IWTP). All domestic sewage, including ship-to-shore sewage transfers, is discharged to the Hampton Roads Sanitary District (HRSD) system. There are 114 NPDES permitted outfalls at SPNC which are monitored in accordance with regulations stipulated by the Virginia State Water Control Board (VSWCB).

4.10.6.2 Summary of Impact Potential and Recommended Actions. SPNC was screened in Study Group 1 in Phase I of this study based on: inadequate hazardous waste storage facilities at NARF; seepage and runoff from the drydock areas; potential for spills from ship-to-shore transfer of sewage; discharge of bilgewater directly overboard; and an underground AVGAS leak reaching Mason Creek. The installation assessment methodology was applied to SPNC during Phase III to better define the likely character and extent of SPNC's impact on local receiving waters. As a result of this assessment, SPNC remains in Study Group 1. Table 4.42 summarizes the areas of concern and recommended actions identified for SPNC. As shown in this table, areas of concern include: the NARF IWTP pretreatment permit violations of heavy metals and phenols; chronic NPDES permit violations of heavy metals, phenols, and oil and grease; and the effect of drydock operations on local receiving waters. In spite of the problems associated with this large industrial installation, a number of innovative techniques are being pursued by the Navy. They include eventual elimination of all contaminant discharges; introduction of the IWTP which is of advanced design and treats industrial wastewater prior to disposal to the HRSD system; and establishment of a toxics monitoring program which is in the early stages of development. Insufficient data exist in the vicinity to determine the precise effects SPNC has on local estuarine waters. Recommended actions for SPNC include:

- Examine the treatment systems and operations of the NARF IWTP to determine the source of recurring violations of the HRSD pretreatment permit.

- Review of BMP at drydock areas to determine their effectiveness and need for upgrading. Coordinate with the State Water Control Board is recommended.

- Investigate source of contaminants in NPDES outfalls and institute a wet weather monitoring program of all stormwater outfalls to identify stormwater washoff constituents and quantities.

Table 4.42 Summary of Areas of Concern and Recommendations for Sewells Point Naval Complex.

Activity/Pollutants of Concern	Onsite	Offsite / Vicinity	Recommendations	Estimated Cost
NARF Industrial Waste Treatment Plant / chromium, cadmium, nickel, cyanide, phenols	The NARF IWTP is of advanced design, but still violates HRSD permit limits for these contaminants.	Elizabeth River suffers from high toxic contamination due to synthetic organics and heavy metals. The mouth of James River and Willoughby Bay have exceeded EPA acute salt water criteria for metals including nickel.	Investigation of the NARF IWTP is warranted to determine source of violations and corrective actions necessary to bring the plant into compliance with HRSD limits.	Study: $175,000 Upgrade: $275,000 +
NPDES Outfalls / heavy metals, phenols, oil & grease	NPDES DMR data for SPNC outfalls show chronic violations of permit limits for O&G, phenols, and heavy metals. The source of these contaminants is not known.	Same as above.	Investigation of the source of these contaminants should be undertaken. A wet weather monitoring program of storm outfalls should be conducted in addition to NPDES monitoring.	I/I Study: $300,000 Monitoring: $200,000/year
Drydock ship maintenance / sandblast contaminants	Contaminant releases from ship maintenance in drydocks is of concern. SPNC is operating under a BMP program in coordination with VAWCB.	Organotins are an identified pollutant in addition to heavy metals in the Elizabeth River and Norfolk Harbor area.	Review of BMPs should be a continuing process to determine their effectiveness and need for upgrading to control releases to receiving waters.	Study: $100,000 Reclamation Unit: $350,000 Grit Vacuum: $70,000

- The inadequate NARF hazardous waste storage facility identified in Phase I of this study will be corrected when a new facility is completed in November 1987.

4.10.7 Installation 22: Naval Supply Center - Craney Island Fuel Terminal (NSC - CI)

4.10.7.1 General. The Naval Supply Center-Craney Island Fuel Terminal (NSC-CI) is located in Portsmouth, Virginia on the western bank of the Elizabeth River. The 874 acre facility is bounded on the north by a dredge material containment area operated by the U.S. Army Corps of Engineers, on the east by the Elizabeth River, on the south by Craney Island Creek, and on the west by residential areas of Portsmouth.

The primary mission of the NSC-CI is the transfer and storage of fuels for the Navy's Sewells Point Naval Complex. With a storage capacity in excess of 2.8 million barrels, NSC-CI is the largest military fuel terminal in the world. Fuel transfer is either by pipeline or at the facility's four piers located on the Elizabeth River.

4.10.7.2 Summary of Impact Potential and Recommended Actions. In Phase I of this study, NSC-CI was screened in Study Group 2 based on: continued leakage problems from vintage underground storage tanks, existence of a reported one million gallon AVGAS/JP5 pool floating on groundwater from a past spill/leak; reported improper functioning of eight oil/water separators during high tide/high flow conditions; and five identified confirmation sites on the installation.

The installation assessment methodology was applied to NSC-CI during Phase III to better define the likely character and extent of its impact on local receiving waters. As a result of this assessment, NSC-CI remains in Study Group 2. Although there exists a significant potential for impact due to the confirmed presence of contaminants in the groundwater wells drilled on site, no offsite measurements were taken to confirm/deny migration of these pollutants. Areas of concern include: the five identified confirmation sites all of which have documented groundwater contamination based on a limited, preliminary data set; the confirmed presence of a 500 foot diameter lens of fuel floating on groundwater less than 200 feet from the site boundary with Craney Island Creek; the continued inefficient operation of eight oil/water separators draining the installation; and frequent leaking underground storage tank (LUST) incidents with attendant ground and surface water contamination. There are several beneficial impacts from operations at NSC-CI such as: operation of oily wastewater treatment plant reclaiming oil from bilge and ballast water for naval installations in Hampton Roads area; a program to phase out older concrete storage tanks and replace with new bermed tanks; and, plans to connect discharge of OWTP to HRSD thus removing one of the point sources from this installation. Table 4.43 summarizes the areas of concern and recommended actions identified for NSC-CI.

Table 4.42 Summary of Areas of Concern and Recommendations for Naval Supply Center - Craney Island Fuel Terminal

ACTIVITY/POLLUTANTS OF CONCERN	ONSITE	OFFSITE/VICINITY	RECOMMENDATIONS	ESTIMATED COST
5 confirmation sites/oil and grease, priority pollutants	NEESA (1983) sampling results groundwater wells at all 5 sites found cadmium, phenols, oil and grease, dieldrin, heptachlorepoxide and mercury at levels exceeding Va. State groundwater standards.	No monitoring was performed during confirmation study for surface waters adjacent to the installation. However, Craney Island Creek is ranked as a Virginia high priority water body due to low D.O., toxics, bacterial levels, and biota degradation	Proceed with confirmation study as outlined by NEESA. Remove all waste oil drums at site no. 4 and construct a new conforming drum disposal area.	<u>Confirmation study</u>: $200,000 <u>Drum removal</u>: $60,000 <u>New storage area</u>: $150,000
5000 ft. diameter, 9.6 ft. thick lens of floating fuel product/ oil and grease, lead, toluene, xylene	WES (1985) found fuel floating on groundwater in area surrounding tank #275 1.6 to 4.0 feet below ground level and up to 9.6 ft. thickness.	Migration offsite to Craney Island Creek has not been confirmed by well data. However, fuel lens is 200 ft. from installation boundary and the creek.	Clean up/remove spilled product (AVGAS/JP5) per recommendations in WES 1985 or best management practices before offsite migration can occur.	$1,000,000 +
LUSTs, oil and grease, PAHs	Confirmation site 5 location of numerous leaks from concrete USTs 1940 vintage. Well samples confirm constituent presence.	Migration offsite definite possibility due to shallow groundwater and system of drainage ditches in this area.	Removal of contaminated soils and clean up soils in contaminated drainage ditches. Continue with design/replacement of older concrete tanks with new larger bermed tanks.	<u>Removal and cleanup</u>: $350,000
Oil-water separators/oil & grease, TSS		Overflow of 8 oil-water separators is reported during highflow conditions on high tide incidents thereby releasing unseparated effluent to Craney Island Creek.	Upgrade separators to prevent accidental release of effluent into adjacent wetlands.	<u>Upgrade 8 separators</u>: $160,000 <u>Develop stormwater mgmt. plan</u>: $50,000

Recommended actions for NSC-CI include:

- Proceed with the upgrading of 8 oil/water separators onsite taking into account high flow and high tide considerations.

- Implement a currently proposed plan to bring in POL overland via pipeline to decrease one hazard of offloading product at the piers.

- Implement current plans to phase out older concrete tanks and replace with new larger tanks enclosed with paved berms.

- Implement recommendations of the U.S. Army COE WES on clean up of AVGAS, JP5 spill/leak at tanks #272 to 278 before migration into Craney Island Creek.

- Implement recommendations of IAS to remove contaminated soils at confirmation site 7 (firefighting training pit) and Site 8 (fuel tank cleaning waste disposal pit), and dispose of properly. Also reconstruct a new impermeable firefighting training pit.

- Remove and dispose of all waste oil drums at confirmation site 4 and construct a new paved, impermeable, bermed holding site for waste oil drums.

- Proceed with the confirmation phase of the NACIP program at all 5 confirmation sites.

4.10.8 Installation 23: Norfolk Naval Shipyard

4.10.8.1 General. Norfolk Naval Shipyard is located in the city of Portsmouth, Virginia about 2 miles south of the city of Norfolk (see Figure 4.16). Located along the South Branch of the Elizabeth River, Norfolk Naval Shipyard is approximately 12 miles south of the U.S. Navy Atlantic Fleet Headquarters at the Sewells Point Naval Complex. Norfolk Naval Shipyard is composed of several non-contiguous areas totaling 1,340 acres; however, the industrial shipyard itself consists of 685 acres. The primary mission of the Norfolk Naval Shipyard is to: (1) provide logistical support to assigned ships and crafts; (2) perform authorized work in connection with construction, conversion, overhaul, repair, alteration, dry docking, and outfitting of ships and craft; (3) perform assigned manufacture, research, development and test work; and (4) provide services and materials to other activities as directed.

4.10.8.2 Summary of Impact Potential and Recommended Actions. In Phase I of this study, Norfolk Naval Shipyard was screened in Study Group 1 based on: frequent violations of effluent limitations at the Industrial Wastewater Treatment Plant (IWTP); the large number and uncertain disposition of confirmation sites on the installation; non-conforming hazardous waste management practices; and, the large percentage of

impervious area drained by 92 point sources discharging into the Elizabeth River.

The installation assessment methodology was applied to Norfolk Naval Shipyard during Phase III to better define (quantify) the likely character and extent of its impact on local receiving waters. As a result of this assessment, Norfolk Naval Shipyard has remained in Study Group 1 as a result of: non-conforming hazardous materials/hazardous waste management practices; non-conforming waste oil storage area; and, potential migration of contaminants from several landfills located along the installation boundary with Paradise Creek. A positive benefit to local receiving waters was the start-up of IWTP operations in 1979 for pretreatment of wastewater before discharge into the Elizabeth River. The IWTP has recently been connected to the City of Portsmouth sanitary sewer system. Table 4.44 summarizes the areas of concern and recommended actions identified for Norfolk Naval Shipyard.

Recommended actions for Norfolk Naval Shipyard include:

- Improve operation and maintenance procedures of waste oil raft (DONUT) equipment to control effluent discharge quality.

- NNSY recently reorganized its environmental staff and added numerous billets personnel in its RCRA program. The installation is progressing rapidly toward full RCRA compliance. NNSY also now has back up contracts for hazardous waste removal in case DLA contracts fail. NNSY is to be commended for taking these actions and it is recommended that they continue to bring the shipyard into compliance with RCRA policies and procedures by:

  a. insuring personnel at generation points know and follow proper waste management procedures;
  b. storing materials only in designated hazardous waste storage areas and not exceeding storage area capacity;
  c. cleaning up spills/leaks immediately;
  d. properly labeling drums and marking storage areas;
  e. segregating wastes at their source to reduce disposal costs (materials already identified) and increasing the possibility for reprocessing or recycling.

- Continue cleanup of confirmation Sites #9 and #17 in accordance with the Navy Installation Restoration Program.

- Continue with confirmation study of Sites #2, #3, #4, #5, #6 and #7 under the Navy Installation Restoration Program with emphasis on identification of migration paths and mitigation of potential surface water contaminants.

Table 4.44 Summary of Areas of Concern and Recommendations for Norfolk Naval Shipyard

ACTIVITY/POLLUTANTS OF CONCERN	ONSITE	OFFSITE/VICINITY	RECOMMENDATIONS	ESTIMATED COST
RCRA-hazardous waste handling and storage/chemicals, sludges, POL.	EPA compliance inspection found many inadequacies in handling, labeling, storage and clean up.		Continue to institute hazardous waste management plan policies and procedures at generation points and storage areas. Establish contract disposal mechanism for hazardous waste sludge disposal not under DRMO jurisdiction.	HW plan: $100,000 HW tracking: $30,000/year
Confirmation Sites #9 and #17/ metals	Groundwater samples have indications of metals at both sites and inorganics at site 17 above acceptable groundwater standards.	Although these sites are not located directly on installation boundaries, the indication of groundwater contamination raises the possibility of offside migration.	Continue with RI/FS site investigations at site 9 and 17 under the Navy Installation Restoration Program.	$200,000 +

Table 4.44 Summary of Areas of Concern and Recommendations for Norfolk Naval Shipyard (continued)

ACTIVITY/POLLUTANTS OF CONCERN	ONSITE	OFFSITE/VICINITY	RECOMMENDATIONS	ESTIMATED COST
Confirmation sites 2, 3, 4, 6, 7/chemicals, solvents, fly ash, asbestos, sludges, acids	Groundwater and soil contamination have been verified by confirmation study.	These sites are located adjacent to Paradise Creek. Groundwater and surface water samples have detected constituents in excess of state criteria. Levels of constituents increase at sampling sites downstream from these landfills indicating definite contamination from these sources.	Continue with confirmation study as identified in IT Corp (1986). Remedial measures should be implemented as required by Navy Installation Restoration Program.	<u>Confirmation study</u>: $175,000 <u>Remedial measures</u>: cost unknown

4.10.9 Installation 74: St. Julien's Creek Annex, NNSY

4.10.9.1 **General**. St. Julien's Creek Annex is a remote installation to the Norfolk Naval Shipyard. The installation is used for storage of materiel taken from ships which are in drydock at the shipyard. A small motor shop on the installation is used for repair and maintenance of the ships' vehicles. There are no other industrial operations on the installation.

4.10.9.2 **Summary of Impact Potential and Recommended Actions**. The screening data for St. Julien's Creek Annex are summarized in Tetra Tech (1986). The Annex was at one time an active ordnance production area with many bomb proof buildings designed for the storage of explosives. Most of these buildings are now unoccupied and have been decontaminated. There are some residual concentrations of Kepone in Building 198 where the EPA had stored Kepone temporarily during cleanup of a plant a number of years ago but concentrations are very low and do not present a hazard to water quality in the area. A NACIP site exists where there was at one time a pesticide and herbicide tank rinsing operation, however, no confirmation study was recommended due to the low residual concentrations. The St. Julien's Creek Annex, NNSY presents few hazards to water quality primarily due to the lack of any significant pollutant sources on the installation. The installation was screened in Study Group 3 (poorly defined but likely insignificant) and was not addressed in detail in Phase III of the study (see also Table 4.39). There are no recommended actions for St. Julien's Creek Annex.

4.11 REGION 10: MOUTH OF BAY

4.11.1 Tributary/Regional Description

4.11.1.1 **Environmental Setting**. The mouth of the Chesapeake Bay, the area between Cape Charles on the north and Cape Henry on the south (see Figure 4.18), is dominated by the marine environment of the Atlantic Ocean. Physically it is a broad, relatively shallow area averaging approximately 25 feet deep. Three channels traverse the shoals, two natural channels, North Channel and Chesapeake Channel and a manmade channel named Thimble Shoals Channel are approximately 40 to 45 feet deep. Local mean tide range is 2.8 feet at Cape Henry where spring tides reach as much as 3.4 feet. Tidal currents are typically on the order of 1.5 feet per second but are locally variable and are often dominated by wind.

Salinity at the Bay's mouth is near ocean salinity (35 ppt) but can range from 25 to 35 ppt. Salinity ranges are not as sensitive to rainfall events as in the middle and upper Bay estuary due to the ocean's domination. This low variation in salinity at the mouth of the Bay provides a relatively stable environment for marine organisms.

The mouth of the Bay is a major wintering and spawning ground for the female blue crab, a commercially valuable species in the Chesapeake Region. Recent years have seen a resurgence of the blue crab indicating good reproductive

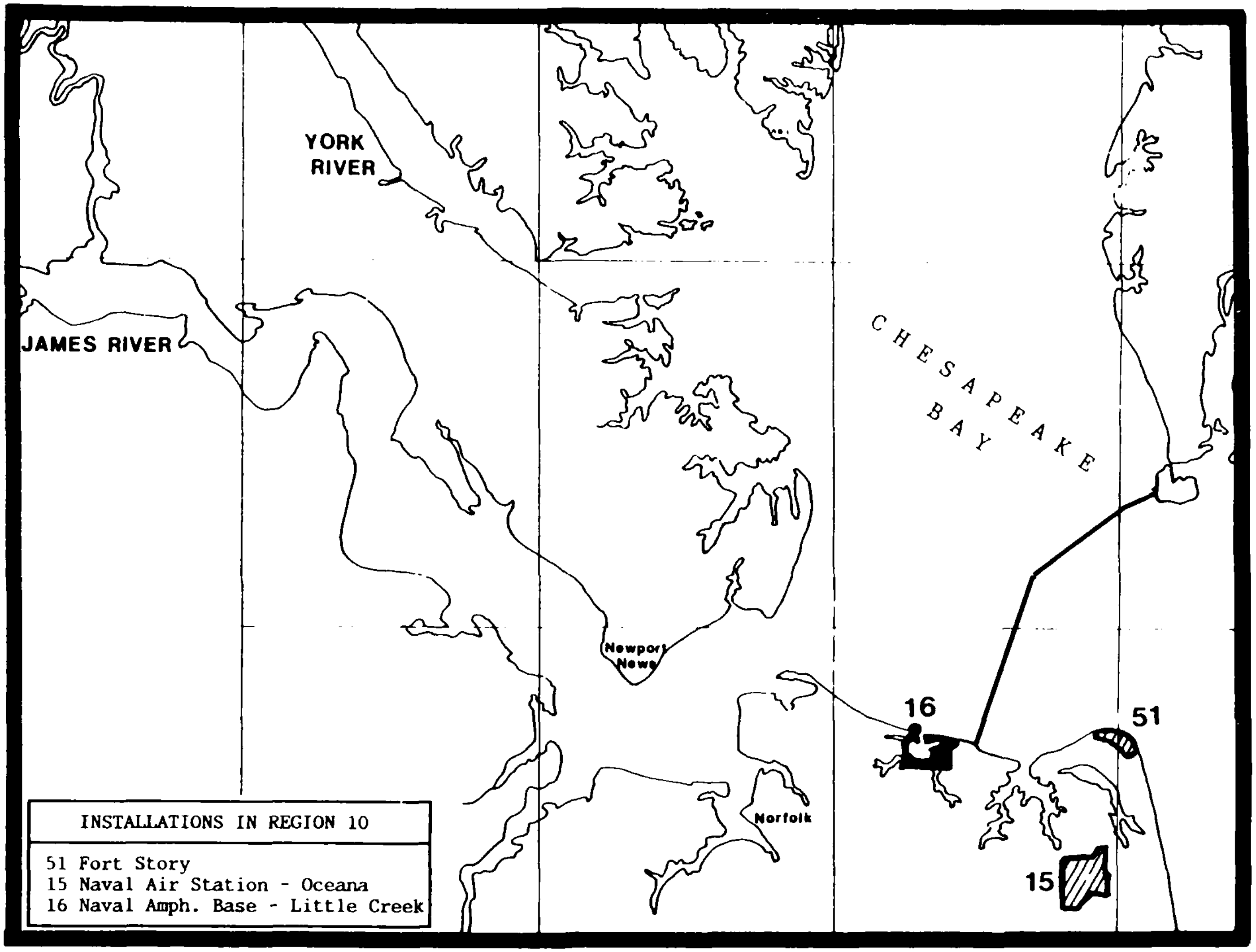


Figure 4.18 Region 10 - Mouth of Bay

conditions. Other commercially valuable species also inhabit the area. Clamming, oystering and commercial and sport fisheries contribute greatly to the local economies.

The mouth of the Bay is a wintering ground for many species of waterfowl, and is the northern terminus of a number of southern species of coastal birds such as the brown pelican.

There are also a number of beaches in this area which support a major recreational industry, as well as unique habitats such as coastal sand dunes and cypress swamps.

The three DoD installations in this region occupy three distinctly different portions of this region, and therefore are discussed separately as follows.

Little Creek. The Naval Amphibious Base dominates the small tributary, Little Creek, located near the mouth of Chesapeake Bay. Other smaller industrial activities are also located on the embayment. Although some wetlands are still present, the land use is primarily urban industrial. The headwaters are controlled to serve as reservoirs for water supply, so the tributary waters are polyhaline, nearly marine in character. The harbor is dredged for large vessels and is largely bulkheaded. Consequently, it is susceptible to stratification and stagnation.

Many marine birds are evident in the area, including the formerly endangered brown pelican. In spite of the nature and intensity of development in this area, water quality remains generally good. The harbor and adjacent open Bay waters are, however, closed to shellfishing because of coliform contamination.

Cape Henry. Fort Story occupies Cape Henry, the sand dune spit at the southern entrance of Chesapeake Bay. Behind the military installation is the Seashore State Park, where the unique dune habitat is preserved. The waters around Fort Story are moderate energy coastal environments, with sandy beaches. The Virginia Capes enclose the migrating pathway for the marine anadromous fishes, as well as the marine spawning fish that utilize the estuary for nursery grounds. The blue crab spawns just inside the Capes, and the larval stages drift critically in the exchange circulation at the mouth of the Bay. Many shore birds utilize the area, especially in the summer months. Local wetlands support diverse plants more characteristic of southern climates, such as cypress, Spanish moss, and oak.

Water quality in this vicinity is generally good, as a result of few waste inputs into a relatively expansive and hydrodynamically well mixed environment.

Lynnhaven River System. Oceana Naval Air Station bounds on the east side of "Canal #2." This "canal" feeds into Linkhorn Bay, to Broad Bay, through the "narrows" to Lynnhaven Bay. Although the area is increasingly suburban, even urban, the subestuary is widely used for sport boating and fishing. Some small fringing marshes still remain, but much shore stabilization has

occurred by individual residences. Water quality is generally fair, but flushing times in the headwaters are relatively slow.

4.11.1.2 Vicinity Pollutant Loads

Point Sources

There are apparently few major point sources in the vicinity of NAS Oceana and NAB Little Creek. The single major point source is the regional HRSD Chesapeake Elizabeth STP located adjacent to NAB Little Creek (see Figure 4.18). The average flow from this STP is about 13.3 MGD. Daily loadings for the following conventional pollutants are: BOD_5 - 692 lbs/day; NH_3-1919 lbs/day; total nitrogen - 2484 lbs/day; total phosphorus - 771 lbs/day; and TSS - 1030 lbs/day. The last remaining domestic wastewater discharge to the Lynnhaven system, Birchwood Gardens STP, has been eliminated and the wastewater is now routed to HRSD.

Nonpoint Sources

Adjacent land use around Oceana consists of fairly dense residential and light industrial uses to the north and east. To the west is the Oceana West Industrial Park. The area to the south is primarily agricultural. VSWCB has reported degraded water quality conditions in the Lynnhaven Bay/Linkhorn Bay system, north of NAS Oceana, due to the surrounding urban/suburban nonpoint source pollutant loadings. Adjacent land use around Little Creek is primarily residential, with some commercial development. On the central southern border of the base is the Hampton Roads Sanitation District (HRSD) Waste Treatment Plant. Norfolk International Airport, whose final approach to the runway crosses over the West Annex portion of the base, is located to the southwest, as is the airport industrial park, the Norfolk Azalea Gardens, and some commercial development. Marina and residential development abut Little Creek to the west. Although Little Creek Cove receives no direct discharges of municipal or industrial wastes, it is subject to boat pollution from NAB Little Creek and commercial marina facilities in addition to residential and commercial nonpoint source contribution (USWCB, 1986). There are no quantitative data available on nonpoint source pollutant loadings for this area.

4.11.1.3 Relative Comparison to DoD Installation Pollutant Loads. In terms of point sources, wastewater from all three DoD installations is pumped to the HRSD Chesapeake Elizabeth STP, located adjacent to NAB Little Creek. In terms of nonpoint sources, the urbanized and industrial activities at NAB, the existence of large sandblasting operations and several oil/water separator devices, and the location of NAB directly on the poorly flushed Little Creek Cove area raises concern over the impact of stormwater runoff on the adjacent surface waters. The commercial (airport) and residential areas also undoubtedly contribute stormwater pollutant loadings to local receiving waters. There are no quantitative estimates of surrounding nonpoint source loads available for comparison purposes.

The relatively large surface area of NAS Oceana, its location near the headwaters of several tidal tributaries, and the nature of activities on the installation raises concern over the impact of stormwater runoff on adjacent surface waters. Several oil/water separators and oil booms on this installation have periodically performed inadequately in controlling release of contaminants (oil and grease, phenols). Although upgrades to this equipment have occurred, ongoing control of contaminants in surface runoff and erosion from NAS remains a concern. There are no quantitative estimates of surrounding nonpoint source pollutant loads for comparison purposes.

4.11.1.4 **Summary of DoD Impacts on the Mouth of Bay**. There are three DoD installations located in this region, as shown in Figure 4.19, representing five percent of the total number of DoD installations in the Chesapeake Bay drainage basin. Of these installations, two (Naval Air Station - Oceana, Naval Amphibious Base-Little Creek) were estimated during Phase I to represent a likely significant impact potential for adverse water quality impacts. These installations received additional analysis during Phase III of the study. Fort Story, however, was estimated to have a likely insignificant impact potential, based on available information.

Table 4.45 presents the results of the final screening for the above three installations. NAS Oceana was screened in Study Group 1 (Significant Impact Potential, Adverse), and NAB Little Creek in Study Group 2 (poorly defined but likely significant impact potential, adverse). Areas of concern for these two installations are similar, and include: potential contaminant migration from several hazardous waste disposal and past spill sites adjacent to surface waters; unknown adequacy of stormwater runoff and fuel spill containment controls; and for NAB Little Creek, possible need to control contaminants from ship sand blasting activities. Available data are generally insufficient to determine the degree of impact from these activities. As is the case at most of the DoD installations, the above activities relate primarily to pollutant sources that are difficult to control or regulate. A number of recommendations have been developed to address these and other areas of concern at the DoD installations in this region. A summary of the findings and recommendations are presented in the following sections.

4.11.2 Installation 16: Naval Amphibious Base, Little Creek (NAB Little Creek)

4.11.2.1 **General**. NAB Little Creek is located in the Tidewater region of southeastern Virginia north of the cities of Norfolk and Virginia Beach. The northern boundary of the installation is Chesapeake Bay proper and the primary receiving water is Little Creek Harbor which flows into Chesapeake Bay. The mission of NAB Little Creek is to provide on-base logistic facilities and other support services to U.S. and allied units to meet the amphibious training and other requirements of the U.S. Armed Forces.

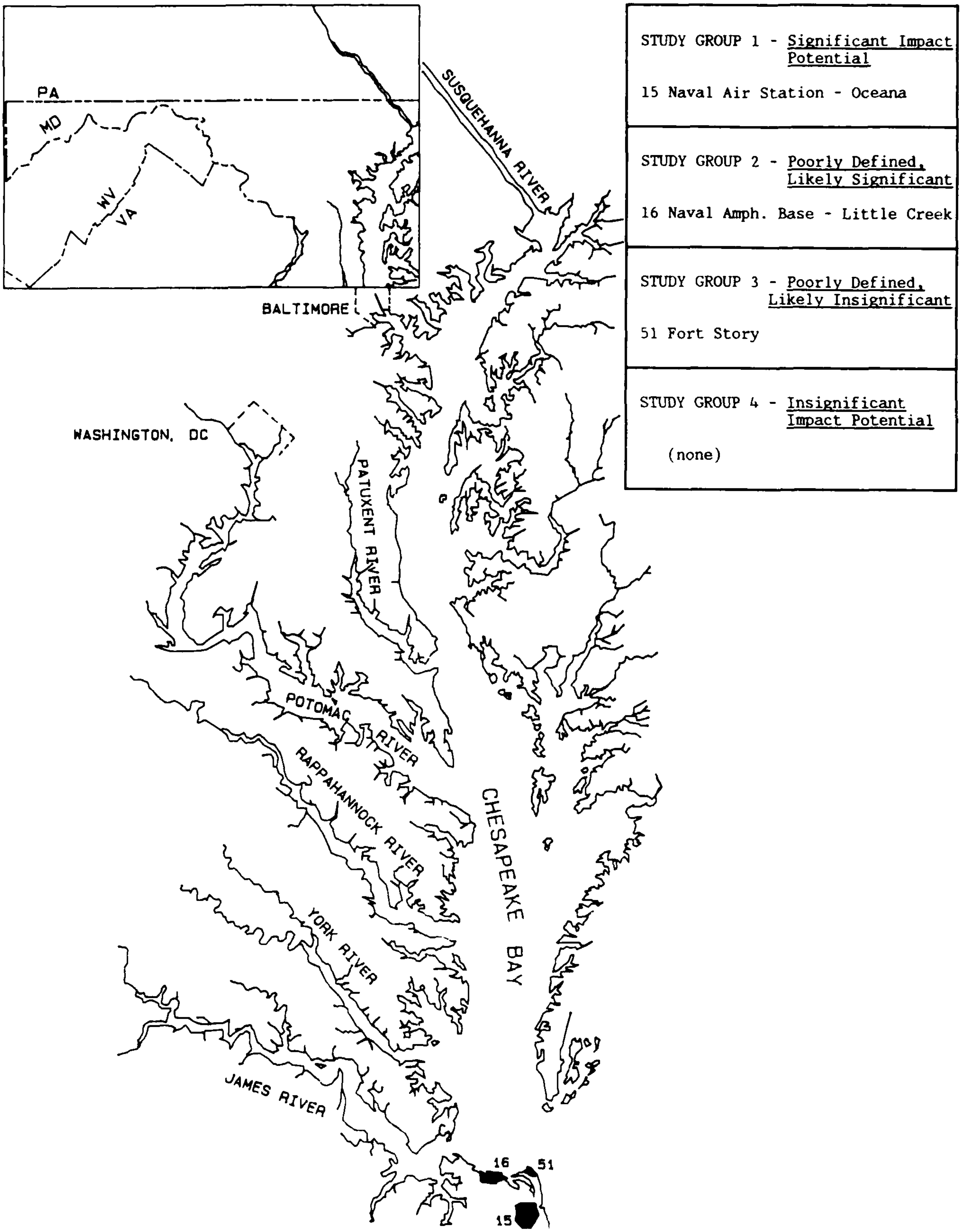


Figure 4.19 Location of DoD Installations in the Mouth of Bay Region and Summary of Installation Impact Potential.

Table 4.45 Summary of Final Screening for Installations in the Mouth of Bay Region

			ON-SITE SCREENING CRITERIA (ON-SITE IMPACT POTENTIAL)																								VICINITY SCREENING CRITERIA							STUDY GROUP			
			NON-POINT SOURCES				POINT SOURCES			HAZARDOUS/TOXIC MATERIALS											ENVIRONMENTAL PROGRAMS						RELATIONSHIP TO LOCAL ENVIRONMENT							IMPACT POTENTIAL			
ID	Branch	Installation Name	1. Erosion/Sedimentation	2. Impervious Area Runoff	3. Combined Storm Drains	4. Shoreline Erosion	5. Sewage Treatment	6. Industrial Waste Treat	7. Intermitt Sewage Treat	8. Refueling Operations	9. Munitions Operations	10. Chemical Operations	11. Pesticides	12. Vehicle Maintenance	13. Ship Maintenance	14. Solid Waste Disposal	15. Hazardous Waste	16. SPCC Status	17. Abandoned Sites	18. LUST Status	19. Forestry Mgmt. Plan	20. Wildlife Mgmt. Plan	21. Soil Conservation Plan	22. Stormwater Mgmt. Plan	23. Wetlands Mgmt. Plan	24. Shoreline Erosion Plan	25. Shellfish Areas	26. SAV Areas	27. Fish Spawning Areas	28. Wetlands Areas	29. Waterfowl Nesting	30. Endangered Species	31. Relative Local Impact	1. Significant	2. Poorly Defined, Sig.	3. Poorly Defined, Insig.	4. Insignificant
51	ARMY	Fort Story	-	·	-	-	·	·	-	-	·	·	·	-	·	·	·	·	·	-	·	·	·	·	+	-	-	·	-	+	+	·	·			X	
15	NAVY	Naval Air Sta-Oceana	θ	-	-	·	·	-	·	θ	·	·	+	θ	·	-	-	-	θ	θ	+	+	-	θ	-	·	-	-	·	-	·	·	θ	X			
16	NAVY	NAB - Little Creek	·	-	-	·	·	·	·	-	·	·	+	·	θ	·	+	-	θ	-	+	+	·	-	-	+	θ	·	·	θ	·	·	-		X		
		Total Number of Installations per Study Group																																1	1	1	0
		Score Totals ·	1	1	0	2	3	2	2	0	3	3	1	1	2	2	1	1	1	0	1	1	2	1	0	1	0	2	2	0	2	3	1				
		+	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1	0	0	0	2	2	0	0	1	1	0	0	0	1	1	0	0				
		⊕	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
		-	1	2	3	1	0	0	1	2	0	0	0	1	0	1	1	2	0	2	0	0	1	1	2	1	2	1	1	1	0	0	1				
		θ	1	0	0	0	0	1	0	1	0	0	0	1	1	0	0	0	2	1	0	0	0	1	0	0	1	0	0	1	0	0	1				

KEY: Impact Category 1: { θ Significant Impact Potential (Adverse)
⊕ Significant Impact Potential (Beneficial)

Impact Category 2: { - Unknown or Poorly Defined Impacts (Adverse)
\+ Unknown or Poorly Defined Impacts (Beneficial)

Impact Category 3: · Insignificant Impact Potential (Adverse or Beneficial)

4.11.2.2 Summary of Impact Potential and Recommended Actions. In Phase I of this study, NAB Little Creek was screened in Study Group 2 (poorly defined but likely significant impact potential) based on the potential contamination of local receiving waters from the various industrial activities on the installation as well as from several inactive waste disposal sites. The installation assessment methodology was applied to NAB during Phase III to better define (quantify) the likely character and extent of NAB's impact on local receiving waters. As a result of this analysis, NAB remains in Study Group 2. Table 4.46 summarizes the areas of concern and recommended actions identified foi NAB. Areas of concern yet unresolved include the introduction of paint and metal wastes from sandblasting activities to Little Creek Cove, existence of a large underground fuel lens near the waterfront, and potential contaminant migration from several inactive hazardous waste disposal sites. Currently there are little or no data available to characterize impact levels, if any, for the above concerns. A NACIP confirmation study is presently underway to investigate the possible existence of leachate migration from the waste disposal sites. Base environmental personnel recognize these concerns and have taken steps to resolve some of them, including diversion of the coal pile runoff into the HRSD treatment system, application for a RCRA part A permit, and application for a NPDES permit for miscellaneous industrial discharges. Recommended actions for NAB Little Creek include:

- Implement confirmation study recommendations, findings, actions, conclusions, and remedial programs in accordance with the Navy Installation Restoration Program. The large number of landfills with unknown contents coupled with the hydraulic gradient, influences the migration of contaminants into surface waters.

- Continue development of wetlands management practices as a part of the fish and wildlife management plan.

- Due to the moderate quantity of hazardous waste generated each month, require base personnel to strictly adhere to a hazardous waste management plan. Monitor compliance with the plan and usage, handling, storage, and disposal guidelines.

- Enforce the updated Spill Prevention Control and Countermeasure (SPCC) Plan and monitor for compliance.

- Monitor the effects from past, current, and future sandblasting activities in Little Creek Cove. The BMP implementation and Virginia NPDES permit may address this issue.

4.11.3 Installation 15: Naval Air Station Oceana (NAS Oceana)

4.11.3.1 General. NAS Oceana is located in the Tidewater region of southeastern Virginia within the City of Virginia Beach. The installation exhibits very flat topography and no primary tributaries pass directly through the facility. However, London Bridge Creek which empties into

Table 4.46 Summary of Areas of Concern and Recommendations for NAB - Little Creek

ACTIVITY/POLLUTANTS OF CONCERN	ONSITE	OFFSITE/VICINITY	RECOMMENDATIONS	ESTIMATED COST
Fuel Leakage - POL products	A 3,000 - 16,000 gallon and a 7,600 - 10,000 gallon fuel leak from past operation exist above water table near waterfront area.	No local data exist to verify potential contamination in receiving waters.	Implement new UST regulations as soon as possible. Implement updated SPCC plan.	UST testing: $400-700/tank SPCC improvements: $500,000+
Sandblasting operation - lead-based paint, metals	Large sandblasting activity exists on peninsula adjacent to Little Creek Cove, and at Pier 10 in close proximity to salt marsh.	Lead-based paint particles found in sediments in Little Creek Cove. Projects in planning stage to upgrade activities.	Perform additional monitoring of sediment quality in area near sandblasting. Feasibility study to determine necessary controls, best management practices.	Monitoring: $50,000 Feasibility study: $60,000 Reclamation unit: $350,000
Hazardous Waste generation, storage, handling	PCB transformers reported to be stored outside (NEESA, 1984). Temporary storage area for HW recently constructed. PCB storage construction to begin FY88. More trained personnel have been added.		Implement updated hazardous waste management plan and contingency plans.	HW plan: $40,000 HW tracking: $15,000/year New PCB storage area: $ 70,000
NACIP inactive waste disposal sites - PCBs, trace organics, metals, POL products, paints, solvents	Six sites identified as having leachate migration potential and are scheduled for monitoring under NACIP program.	No data available.	Recommendations await findings of confirmation studies.	Confirmation study: $100,000
Storm runoff, wetlands impacts	Wetlands and vegetation on base have been destroyed, damaged due to base expansion, training activities.		Continue development of land management and wetlands management plans. Implement stormwater management plan using best management practices.	Plan development: $50,000

Lynnhaven Bay lies within 3000 feet of the northwest corner of the installation. The mission of NAS Oceana is to maintain and operate facilities and provide services and material to support Naval aviation and other activities.

4.11.3.2 <u>Summary of Impact Potential and Recommended Actions</u>. In Phase I of this study, NAS Oceana was screened in Study Group 1 (significant impact potential, adverse) based on the existence of extensive fuel leakage into the ground near surface waters, uncertain effectiveness of oil spill containment equipment in drainage canals, surface erosion in drainage pathways, and potential leachate migration into surface waters from several hazardous waste disposal areas. The installation assessment methodology was applied to NAS during Phase III to better define the likely character and extent of NAS's impact on local receiving waters. As a result of this analysis, NAS remains in Study Group 1. Table 4.47 summarizes the areas of concern and recommended actions identified for NAS. Areas of concern include inadequately controlled stormwater runoff and questionable efficiency of oil/water separators, lack of detention basins for sediment retention, and unresolved status of leachate migration potential for several inactive hazardous waste disposal and spill sites adjacent to surface waters. Recently, NAS Oceana has instituted a number of improvements that should result in environmental benefits, including performance of an infiltration/inflow study to reduce waste flow to HRSD, installation of new oil containment booms in major drainage canals, implementation of erosion controls around the landfill area, renovation of temporary hazardous waste storage buildings, preparation of a land management plan and natural resources plan, and hiring of additional environmental management personnel. Recommended actions for NAS Oceana include:

- Implement updated SPCC plan and include more frequent maintenance/replacement of the floating oil booms on the major stormwater drainage canals.

- Implement confirmation study recommendations, findings, actions, conclusions, and remedial programs. The large landfills with unknown contents in conjunction with the hydraulic gradient for migration into the surface waters present a high potential for contamination of surface waters, especially if contents are disturbed.

- Continue with current project to update soil conservation/land management plan to reduce the adverse impact on base vegetative cover and biota due to activities on site. It should also address new property acquired by NAS Oceana, its use and management practices. Also, continue with implementation of fish and wildlife plan that includes wetlands management practices to reduce impacts to wetlands.

- Implement engineering and construction activities to reduce the erosion along drainage canals and at the landfill site.

Table 4.47 Summary of Areas of Concern and Recommendations for NAS Oceana

ACTIVITY/POLLUTANTS OF CONCERN	ONSITE	OFFSITE/VICINITY	RECOMMENDATIONS	ESTIMATED COST
Wash Rack effluent and Storm Runoff-Oil & Grease, phenols	Violations of NPDES permit limits for oil & grease, phenols occur at some oil/water separators, and permanent oil booms in drainage canals. Five oil booms have been replaced in FY 86.	Surface waters affected by NAS Oceana include London Bridge Creek, Great Neck Creek, Owl Creek, Malbon Creek, the Lynnhaven River, and Linkhorn Bay. Water quality problems in area include elevated bacteria, sedimentation, and copper, lead, nickel and zinc levels exceeding the EPA saltwater chronic criteria. NAS Oceana's contributions poorly defined but potentially significant. Local waterbodies identified as nursery areas for migratory and and resident fish species, as well as a wintering and spawning ground for blue crab.	Develop stormwater management plan for installation, include self monitoring of discharge points to determine need for additions/upgrades to oil/water seperators. Implement updated SPCC plan.	<u>Develop plan</u>: $50,000 <u>Upgrades</u>: $20,000/separator
Stormwater Runoff and Erosion-sedimentation, silt, oil and grease.	Erosion and sedimentation observed along drainageways. No retention basins exist for sediment retention/control.		Feasibility study to determine need for stormwater/erosion controls (retention basins, slope protection, etc.). Continue updating soil conservation/land management plans, and fish and wildlife plans which includes wetlands management practices.	<u>Feasibility study</u>: $150,000 <u>Update soil conservation plan</u>: $30,000 <u>Update wetlands management plan</u>: $25,000
Leaking UST and underground supply lines - JP-4, JP-5, AVGAS.	Thousands of gallons leaked into groundwater at tank farm located near freshwater wetlands. Preliminary studies for cleanup underway.		Implement recommendations for clean up operations. Implement new UST proposals developed in-house as soon as regulations go into effect.	$1,700,000
NACIP confirmation sites-waste POL, chlorinated hydrocarbons, PCB's, heavy metals, pesticides.	Several inactive waste disposal sites under NACIP confirmation studies. Sites are located near surface waters. Groundwater and surface water sampling data not available for review		Implement confirmation study recommendations, remedial actions. Institute monitoring program for nonconfirmation sites located near surface waters.	<u>Additional sites confirmation study</u>: $100,000 <u>Remedial actions</u>: costs unknown

Postconstruction monitoring of these long-term engineering solutions should also be implemented to determine the effectiveness of the practices.

- Increased water quality and environmental monitoring frequency is recommended. This monitoring, which would be in addition to that required by regulatory agencies, would be very useful in the early detection of potential problem areas and assist in the determination of the need for additional engineering/environmental controls or changes in management practices at NAS Oceana.

- The planned addition of massive increases in paved areas (Master Plan, 1984) will increase the overall runoff water collected by the storm sewer system resulting in additional discharge. Inadvertent spills or pollutants on the impervious surfaces will be carried by storm waters, potentially causing greater pollution of receiving waters and increased erosion. An effective stormwater management plan addressing the increased impervious areas should be implemented and strictly enforced to minimize the impacts of the planned improvements. Also, remedial steps should be taken to mitigate the loss of existing vegetation due to construction activities.

4.11.4 Installation 51: Fort Story

4.11.4.1 General. Fort Story is a remote installation to Fort Eustis, the Army's transportation center, and as such is used for the Army's Logistics Over The Shore (LOTS) training. The installation is 1439 acres located on Cape Henry in Virginia at the mouth of the Chesapeake Bay approximately 29 miles east of Norfolk. In addition to the LOTS training there is a Navy Explosive Ordnance Disposal (EOD) facility on Fort Story which occasionally uses the installation for training.

4.11.4.2 Summary of Impact Potential and Recommended Actions. The screening data for Fort Story are summarized in Tetra Tech (1986). Fort Story is an installation with relatively few activities but the nature of these activities causes some concern for water quality in the Chesapeake Bay and in the marshes and ponds on and adjacent to the installation.

a. The training which takes place at the installation causes severe disturbance of the beach and foredune system in limited areas of the installation. However, the impacts on water quality from the erosion of sand sized sediment are limited to the nearshore area adjacent and just downdrift of the training area, and are not well documented.

Fort Story's role as a LOTS training facility and some as yet unresolved questions about sewage disposal have resulted in the screening of this installation in Study Group 3 (poorly defined but likely insignificant) (see also Table 4.45). Fort Story was not addressed in Phase III of the study. Recommended actions for Fort Story relate to use of BMP'S for overload and shoreline erosion control, and are summarized in Chapter 5.

4.12 REGION 11: SUSQUEHANNA RIVER

4.12.1 Tributary/Regional Description

4.12.1.1 Environmental Setting. The Susquehanna river and its tributaries account for about 50% of the freshwater inflow to the Chesapeake Bay. From its origin in the Finger Lakes country in New York State, the river flows southward through the mountainous Appalachian and Piedmont provinces, and the fertile agricultural valleys of central Pennsylvania to the head of the Bay in Maryland (see Figure 4.20). Several large tributaries contribute to the flows.

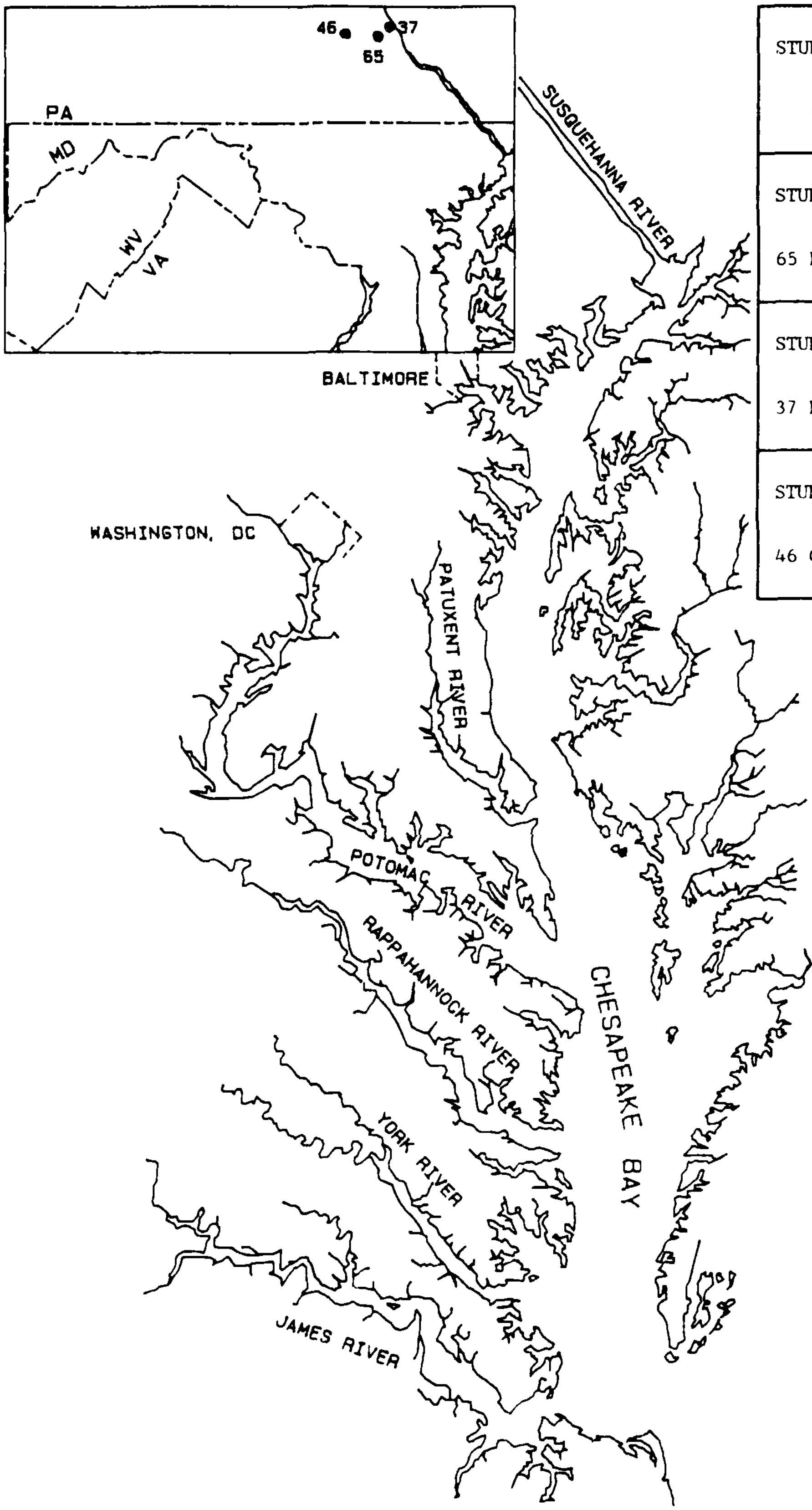
Along its length, the Susquehanna flows through undeveloped mountain habitats, agricultural land, coal mining areas, urban and suburban settings, and heavy industry. As this is the largest single contributor of fresh water to the Chesapeake estuary, its influence is significant. The Susquehanna dominates the water quality and flow regimes of all of the small rivers at the head of the bay north of Kent Island. Recent studies have indicated that the water quality at the head of the Bay is impacted by relatively high concentrations of nutrients, heavy metals, and transported particulates.

Water quality in the mainstem Susquehanna, because of the relatively large volume, is generally good.

4.12.1.2 Vicinity Pollutant Loads

Point Sources

Point sources in the lower Susquehanna basin (from Sunbury, Pennsylvania to the Pennsylvania-Maryland state line) include approximately 120 municipal, 250 non-municipal and 240 industrial wastewater treatment plants (PADER, 1980). As of 1980, over 82% of the municipal plants and a similar proportion of the non-municipal plants provided at least a secondary level of treatment. Most of the industrial treatment plants provide at least secondary treatment, while many treat for specific constituents. These private treatment facilities handle wastewater from a variety of industries including quarries, coal processing, metals, chemicals, food processing and paper mills. Some of these treatment facilities are improperly operated, exceed the capacity to adequately treat the waste or, need upgrading to improve water quality (PADER, 1980).



STUDY GROUP 1 - Significant Impact Potential

(none)

STUDY GROUP 2 - Poorly Defined, Likely Significant

65 Navy Ship Parts Control Center

STUDY GROUP 3 - Poorly Defined, Likely Insignificant

37 New Cumberland Army Depot

STUDY GROUP 4 - Insignificant Impact Potential

46 Carlisle Barracks

Figure 4.20 Location of DoD Installations in the Susquehanna River Region and Summary of Installation Impact Potential.

Nonpoint Sources

Drainage from abandoned coal mining operations is the most significant source of nonpoint pollution in the area. These acidic discharges are diluted and neutralized by additional flow from other tributaries before reaching the larger streams. Other nonpoint sources of pollution which are evident in the area occur from urban runoff and accelerated erosion and sedimentation as well as nutrient runoff from agricultural activities (PADER, 1980).

4.12.1.3 **Relative Comparison to DoD Installation Pollutant Loads**. Of the three DoD installations in this region, only one, New Cumberland Army Depot, operates a sewage treatment plant. This secondary STP is reported to be in full compliance with NPDES regulations.

Comparatively, the DoD installations contribute an insignificant pollutant loading to the Susquehanna River.

In terms of nonpoint sources, the DoD installations also contribute insignificant pollutant loads to the Susquehanna. A concern has been identified at NSPCC, however, related to potential contamination of local small tributaries from stormwater runoff originating on this industrialized facility. These concerns are subsequently discussed.

4.12.1.4 **Summary of DoD Impacts on the Susquehanna River**. There are three DoD installations located in this region, as shown in Figure 4.20, representing five percent of the total number of DoD installations in the Chesapeake Bay drainage basin. Two of these installations (Carlisle Barracks, New Cumberland Army Depot) were estimated during Phase I to represent a likely insignificant potential for adverse water quality impacts. The third installation (Navy Ship Parts Control Center) was screened in Study Group 2 (poorly defined but likely significant impact potential), and received additional analysis during Phase III of this study.

Table 4.48 presents the results of the final screening for the above three installations. The assignment by Study Group for these installations remains unchanged from the Phase I screening. In general, the overall effect of DoD activities on the Susquehanna River are believed to be insignificant. Areas of concern at Navy SPCC include stormwater runoff from ore piles and from impervious surfaces, potential for migration of trace organics from past spill areas to local surface water drainage, and potential contamination from remote septic systems. Little data exists, however, to verify the level of impact of NSPCC on the quality of local receiving waters.

4.12.2 Installation 37: New Cumberland Army Depot (NCAD)

4.12.2.1 **General.** NCAD is located in south-central Pennsylvania approximately five miles south of Harrisburg in York County. The depot consists of 832 acres. A small tributary to the Susquehanna, Marsh Run

Table 4.48 Summary of Final Screening for Installations in the Susquehanna River Region

ON-SITE SCREENING CRITERIA (ON-SITE IMPACT POTENTIAL) — NON-POINT SOURCES (1–4); POINT SOURCES (5–7); HAZARDOUS/TOXIC MATERIALS (8–18); ENVIRONMENTAL PROGRAMS (19–24)

ID	Branch	Installation Name	1. Erosion/Sedimentation	2. Impervious Area Runoff	3. Combined Storm Drains	4. Shoreline Erosion	5. Sewage Treatment	6. Industrial Waste Treat	7. Intermitt Sewage Treat	8. Refueling Operations	9. Munitions Operations	10. Chemical Operations	11. Pesticides	12. Vehicle Maintenance
46	ARMY	Carlisle Barracks	·	·	·	·	·	·	·	·	·	·	·	·
65	NAVY	Navy SPCC	·	-	·	·	·	·	-	-	·	·	·	·
37	ARMY	New Cumberland Depot	·	+	·	·	+	⊕	·	+	·	⊕	·	·

Installation Name	13. Ship Maintenance	14. Solid Waste Disposal	15. Hazardous Waste	16. SPCC Status	17. Abandoned Sites	18. LUST Status	19. Forestry Mgmt. Plan	20. Wildlife Mgmt. Plan	21. Soil Conservation Plan	22. Stormwater Mgmt. Plan	23. Wetlands Mgmt. Plan	24. Shoreline Erosion Plan
Carlisle Barracks	·	·	·	+	·	·	·	·	+	+	·	·
Navy SPCC	·	·	·	+	-	-	·	·	·	-	·	·
New Cumberland Depot	·	·	+	+	+	·	·	+	+	+	⊕	·

VICINITY SCREENING CRITERIA — RELATIONSHIP TO LOCAL ENVIRONMENT (25–31); **STUDY GROUP** — IMPACT POTENTIAL (1–4)

Installation Name	25. Shellfish Areas	26. SAV Areas	27. Fish Spawning Areas	28. Wetlands Areas	29. Waterfowl Nesting	30. Endangered Species	31. Relative Local Impact	1. Significant	2. Poorly Defined, Sig.	3. Poorly Defined, Insig.	4. Insignificant
Carlisle Barracks	·	·	·	·	·	·	·				X
Navy SPCC	·	·	·	·	·	·	-		X		
New Cumberland Depot	·	·	·	⊕	⊕	·	+			X	
Total Number of Installations per Study Group								0	1	1	1

Score Totals

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
·	3	1	3	3	2	2	2	1	3	2	3	3	3	3	2	0	1	2	3	2	1	0	2	3
+	0	1	0	0	1	0	0	1	0	0	0	0	0	0	1	3	1	0	0	1	2	2	0	0
⊕	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0
-	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0
Θ	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	25	26	27	28	29	30	31
·	3	3	3	2	2	3	1
+	0	0	0	0	0	0	1
⊕	0	0	0	1	1	0	0
-	0	0	0	0	0	0	1
Θ	0	0	0	0	0	0	0

KEY: Impact Category 1: { Θ Significant Impact Potential (Adverse); ⊕ Significant Impact Potential (Beneficial)

Impact Category 2: { - Unknown or Poorly Defined Impacts (Adverse); + Unknown or Poorly Defined Impacts (Beneficial)

Impact Category 3: · Insignificant Impact Potential (Adverse or Beneficial)

Creek, traverses the south side of the installation and water quality in this creek is marginal. The principal mission of the depot is to supply and provide for the receipt, storage, issue, maintenance, and disposal of assigned commodities. In addition, the installation provides support to attached organizations and operates other facilities as assigned.

4.12.2.2 **Summary of Impact Potential and Recommended Actions**. The NCAD screening data are presented in Tetra Tech (1986). Based on the screening criteria, NCAD was screened in Study Group 3, having a poorly defined but likely insignificant potential impact level on the Chesapeake Bay and related ecological resources. This judgement is based on the following observations:

a. Impervious area equals 260 acres with effective stormwater management practices. Construction sites utilize sediment control methods. Basic depot drainage is to Marsh Run Creek and Marsh Run Pond. There is no reported erosion problem on the depot.

b. A secondary sewage treatment plant is in full compliance with NPDES regulations. Industrial wastewater generation has been greatly reduced due to decommissioning of the helicopter maintenance activity. An equalizer helps in controlling peak flows due to chronic infiltration.

c. Major refueling operations have conforming spill prevention controls. A few minor storage areas need to be bermed.

d. Monitoring wells around a former landfill and former solvent tank area have detected some contamination but no migration off the installation. UST testing is ongoing and old tanks are being removed once they are emptied. There are no sites warranted for confirmation studies.

e. Hazardous waste storage area is to be enclosed and ventilated. Presently, the area has segregation, safety equipment, bermed area, and contained drainage. NCAD has a hazardous waste response team, repacking facility, and all required equipment for dealing with spills.

f. The Marsh Run wetland area is undisturbed and has habitat and wildlife enhancement programs.

NCAD has terminated a major pollutant loading activity associated with the helicopter maintenance activity. NCAD was not examined further under Phase III of this study. A recommended action for NCAD relates to completion of UST testing, and is summarized in Chapter 5.

4.12.3 Installation 46: Carlisle Barracks (CB)

4.12.3.1 **General**. CB occupies 402 acres in Cumberland County, Pennsylvania, approximately 18 miles west of Harrisburg. The vicinity is agricultural and suburban in character, with some light industry. Letort Spring Run flows through the installation, and joins Conodoguinet Creek, a tributary to the Susquehanna River near Harrisburg. Letort Spring Run is managed as a cold water trout stream by the State of Pennsylvania, with native brown trout and stocked with rainbow trout. Water quality is generally good. CB is the home of the US Army War College and a host of other United States Armed Forces units and activities. The primary mission of CB is to prepare selected students for high level staff and command positions within the Army and throughout the Defense establishment.

4.12.3.2 **Summary of Impact Potential and Recommended Actions**. The screening data for CB are presented in Tetra Tech (1986). Based on this information, CB was screened in Study Group 4, having an insignificant impact level on the ecological resources of the Chesapeake Bay (see Table 4.48). This judgement is based on the following observations:

a. Carlisle Barracks land use activities include housing, recreation, academic buildings, and community and maintenance facilities. CB is considered a small generator (less than 100 kg per month) of hazardous waste. Domestic wastewater is treated offsite by the regional sewage treatment plant. An NPDES permitted outfall is for the filter backwash of the water treatment plant. The banks of Letort Spring Run have been maintained with stone walls which create aesthetic appeal as well as control stream bank erosion. The barracks has little impact on local ecology due to its academic mission.

Carlisle Barracks was not examined further in Phase III of this study. The potential impact of the installation is limited due to its academic mission. There are no recommended actions for Carlisle Barracks.

4.12.4 Installation 65: Navy Ships Parts Control Center (NSPCC)

4.12.4.1 **General**. NSPCC is located in Mechanicsburg, Pennsylvania, about seven miles west of Harrisburg in a region known as Cumberland Valley. The installation occupies 824 acres of which half is covered by buildings, pavement, and railroads. NSPCC lies on the watershed divide between Conodoguinet Creek and Yellow Breeches Creek, both of which flow into the Susquehanna River. Surface water runoff from most of the base is collected by a storm sewer and discharged to a drainage channel which flows to Trindle Spring Run, a tributary of Conodoguinet Creek. A small portion of surface runoff from the facility enters a sinkhole on the east side of NSPCC where it enters the groundwater aquifer and eventually recharges Yellow Breeches Creek. The Defense Depot Mechanicsburg (DDM) and Defense Property Disposal Office (DPDO) are both DLA activities and are tenants at NSPCC. DDM's mission is to receive, store, and

issue DLA commodities and general supplies to military installations in its assigned area. The mission of DPDO is to dispose of property in support of military services, federal agencies, and other customers.

4.12.4.2 **Summary of Impact Potential and Recommended Actions**. NSPCC was screened in Study Group 2 in Phase I of this study based on the potential for spills due to the large storage capacity of fuel oil, the potential for contamination from four abandoned waste sites, stormwater runoff from the highly impervious areas, and eight remote septic systems. The installation assessment methodology was applied to NSPCC during Phase III to better define the likely character and extent of NSPCC's impact on local receiving waters. As a result of this analysis, NSPCC remains in Study Group 2. Table 4.49 summarizes the areas of concern and recommended actions identified for NSPCC. As shown in this table, areas of concern include stormwater runoff from ore piles and from impervious surfaces; potential for migration of TCE solvents along fracture traces to Trindle Spring Run; and potential contamination from eight remote septic tanks on base. Very little data exists to determine the impact of NSPCC on the quality of local receiving waters. Recommended actions for NSPCC include:

- Establish a surface water quality monitoring program to detect contaminants that may be leaving NSPCC by surface drainage.

- Findings of NACIP Phase II study need to be reviewed to determine appropriate recommendations for abandoned waste sites.

- Establish a wet weather stormwater monitoring program in the NSPCC Drainage Ditch and investigate need for oil/water separators or other stormwater quality control devices.

- Connect the remaining eight septic tanks to the existing sanitary sewer which discharges to the Hampden Township Regional STP.

- Follow proper spill control procedures during planned in-place demolition of unused fuel storage tanks at fuel farm area.

- Future expansion of NSPCC creating more impervious surfaces must address stormwater runoff impacts on downstream areas.

4.13 REGION 12: NON TIDAL PATUXENT

4.13.1 Tributary/Regional Description

4.13.1.1 **Environmental Setting**. The non-tidal Patuxent River originates in the Piedmont nearly at the Fall Line and flows southeastward, parallel to the mainstem Chesapeake Bay (see Figure 4.21). The headwaters are dammed to form reservoirs for water supply to the District of Columbia metropolitan area, which is ultimately diverted

Table 4.49 Summary of Areas of Concern and Recommendations for Navy Ships Parts Control Center.

ACTIVITY/POLLUTANTS OF CONCERN	ONSITE	OFFSITE/VICINITY	RECOMMENDATIONS	ESTIMATED COST
Stormwater runoff from ore piles / TSS, BOD, iron	Surface water samples in 1983 at SW4 show pH of 5.6 which is below state standard. Iron levels of 0.99 mg/L exceed state standard of 0.3 mg/L of dissolved iron.	There is evidence of degraded water quality including elevated levels of BOD, TSS, and phosphorus along with reduced biological community in Trindle Spring Run. Elevated iron levels exceed state standards in Yellow Breeches Creek.	Institute a surface water quality monitoring program to detect contaminants that may be leaving NSPCC by surface water drainage paths.	<u>Monitoring</u>: $30,000/year
NACIP Conformation Site 7 TCE solvent and sludge	13,000 gallons of waste solvent containing TCE has been disposed here. Potential exists for migration along underground faults to Trindle Spring Run.	No data exist to verify whether contaminants from this site are reaching surface waters of Trindle Spring Run.	Continue with RI/FS under Navy's Installation Restoration Program at this confirmation site.	<u>Continued Sampling</u>: $ 50,000 to $100,000
Remote Septic Tanks / contamination of groundwater	There are eight (8) remote septic tanks on NSPCC grounds.	Highly permeable nature of the underlying carbonate rock has potential to carry contaminants offsite to private drinking wells and to Trindle Spring Run.	Connect septic tanks to existing sanitary sewer which discharges to the Hampden Township Regional STP. This will require about 7100 feet of sewer pipe.	$350,000
Stormwater Runoff / Oil-water separators / NPDES permit	High percentage of installation is impervious and urban-type stormwater quality problems may exist. No data exist on quality of stormwater runoff.	Downstream flooding of residences is already a problem. Water quality during storm events in Trindle Spring Run is not known.	Institute a wet weather stormwater monitoring program in NSPCC Drainage Ditch and investigate need for oil/water separators on base.	<u>Monitoring</u>: $30,000/year <u>Develop Plan</u>: $20,000
Demolition of Abandoned Fuel Storage Tanks / residual oil	Abandoned tanks in Fuel Farm area are scheduled for demolition. Potential exists for spills from residual oil remaining in tanks.	Oil may seep into ground water and follow fracture traces to Trindle Spring Run and pollute surface waters.	Follow strict spill control procedures during demolition of tanks including installation of secondary containment as necessary.	<u>Containment</u>: $150,000

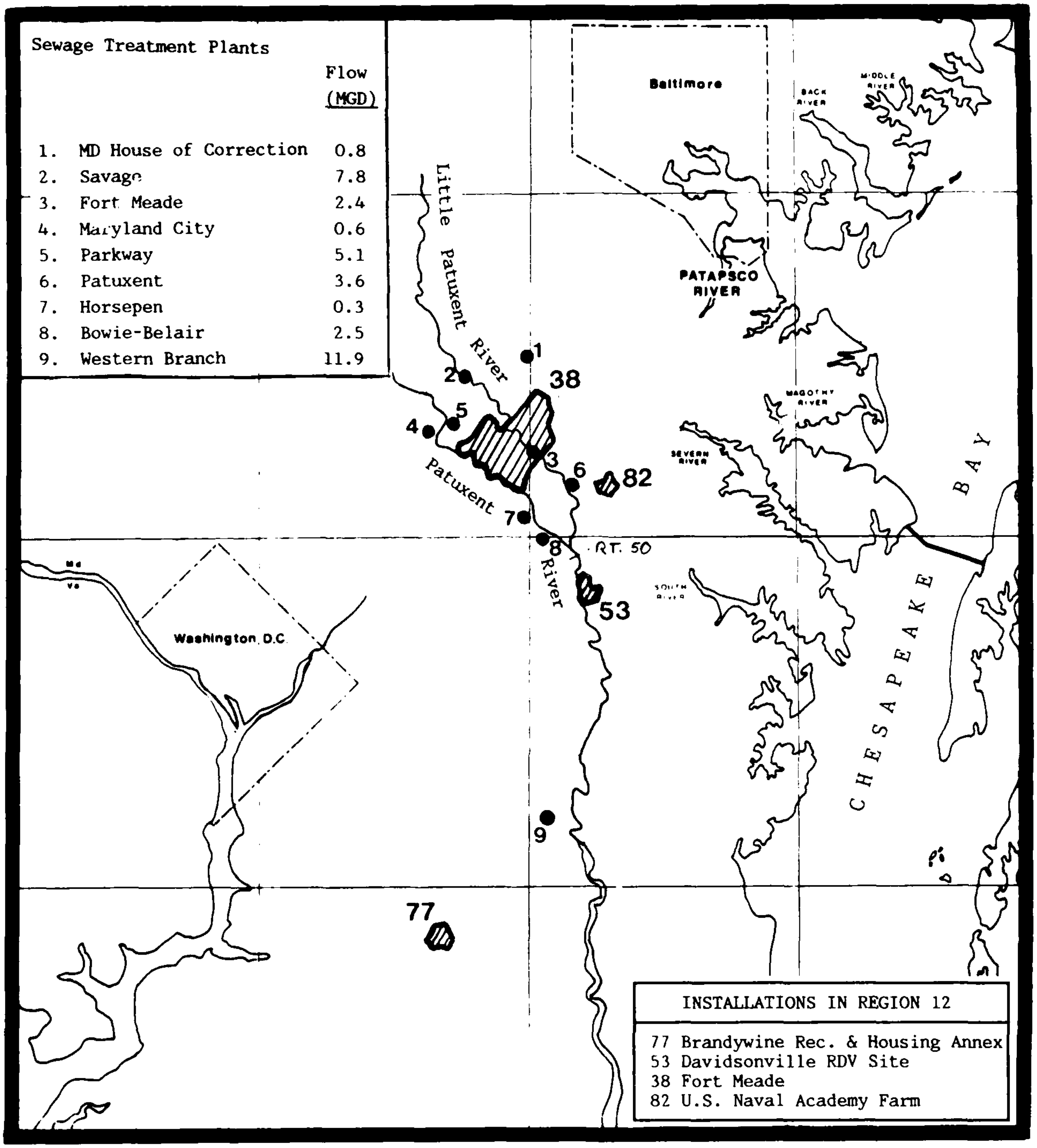


Figure 4.21 Region 12 - Non-Tidal Patuxent River

to the Potomac River. Extensive development is found in the Baltimore - Washington corridor upriver from the Army installation at Ft. George G. Meade, and the river receives treated sewage above the Army base, at the Army base, and downstream. It has been estimated that at summer low flow conditions, half the freshwater input to the estuary is treated sewage. Developmental pressures have led to special studies of the carrying capacity of this relatively small stream, and sewage effluent loading must be allocated.

EPA characterizes water quality in the lower river as fair, with enrichment of nutrients, toxics, and high turbidity. There has been accelerated siltation in this area, mostly due to upstream development and numerous abandoned sand and gravel operations. Increasing developmental pressure and stresses on this region are expected, consequently, the State of Maryland is intensively studying the river to develop effective management strategies for the future.

Downstream from Ft. Meade, on a tributary to the Little Patuxent River, the U.S. Naval Academy maintains a full scale dairy, servicing a population of approximately 5,000. A few miles further downstream of the above installations, just below the confluence of the Little Patuxent River and the Patuxent River, is the Air Force Transmitter Station, near Davidsonville. This is in a rural setting, located next to the limited access east-west highway, U.S. 50. These facilities are on a riverine system nearly loaded to its carrying capacity for treated wastes, and thus must be factored into the basin planning.

4.13.1.2 Vicinity Pollutant Loads

Point Sources

There are several significant discharges to the Patuxent River upstream of the DoD installations including Johns Hopkins University Research Farm, W.R. Grace Co., University of Maryland Farm, and the Maryland House of Corrections STP (see Figure 4.21). The Little Patuxent (Savage) STP discharges approximately one quarter km downstream from the Fort Meade outfall. The water is characterized by high bacteriological and viral counts associated primarily with STP effluent. There are a total of 36 NPDES permitted municipal discharges into the Patuxent River basin. Most of these are small (less than 1 MGD) and discharge to surface waters. Six are major discharges and include Western Branch, Bowie, Horsepen Branch (Bowie), Parkway, Little Patuxent (Savage), and Patuxent (Crofton) STPs. During periods of low freshwater flow, the wastewater treatment plants comprise about 30% of the total flow at the Rt. 50 bridge. There are 47 NPDES permitted industrial discharges into the Patuxent River basin. Except for the General Electric plant in Columbia and the Chalk Point Power Plant at Benedict, most of the discharges are small and discharge to surface waters.

Nonpoint Sources

The Patuxent River basin drains about 930 square miles of land area. About one-third of the land is agricultural and only about 13% is developed. As evidence of the rapid urbanization, however, the amount of developed land increased more than 27% between 1973 and 1981. Suspended solids, turbidity, and phosphorus and nitrogen loading from urban and agricultural runoff and faulty septic tank systems contribute to the degradation of the Patuxent River water quality.

Estimates of the average nutrient load from nonpoint sources above the Fall line are approximately 4470 lbs/day nitrogen and 1290 lbs/day phosphorus (Maryland DNR, 1982). There are no estimates available for metals or toxics loading to this area from nonpoint sources. A nonpoint source pollution monitoring program is currently underway in the Patuxent River and estuary by the USGS and Maryland OEP. Data collected will be combined with urban and forest runoff estimates and known point source loadings to create a watershed model to help manage Patuxent River water quality.

4.13.1.3 Relative Comparison to DoD Installation Pollutant Loads

In terms of point sources, the DoD installations presently contribute a relatively minor pollutant loading to the Patuxent River. The Fort Meade STP accounts for about 17% of the sewage treatment flow to the Little Patuxent, and about 7% of the sewage treatment flow to the entire Patuxent River. Fort Meade's impact is actually less than this, however, since the relatively new STP is a tertiary plant with advanced treatment processes including nitrification and multi-media sand filters.

In terms of nonpoint pollutant sources, the four DoD installations in this area appear to be relatively minor contributors to the Patuxent River. In terms of land area, the DoD installations represent about 2% of the total drainage area to the Patuxent River. Based on estimates of loadings for nutrients, the DoD installations contribute approximately 2% of the total nitrogen and less than 1% of the phosphorus to the Patuxent from runoff, based on the estimates prepared during this study.

4.13.1.4 Summary of DoD Impacts on the Non-Tidal Patuxent. There are four DoD installations located in this region, as shown in Figure 4.22, representing seven percent of the total number of DoD installations in the Chesapeake Bay drainage basin. Two of these installations (Naval Academy Dairy Farm, Davidsonville RDV) were estimated during Phase I to represent a likely insignificant impact potential for surface water quality. Brandywine RDV and Fort Meade were screened in Study Group 2 (poorly defined but likely aignificant impact potential), and received additional analysis during Phase III of the study.

Table 4.50 presents the results of the final screening for the above four installations. Based on the additional analysis during Phase III, Brandywine RDV was reassigned to Study Group 3 because measures have been

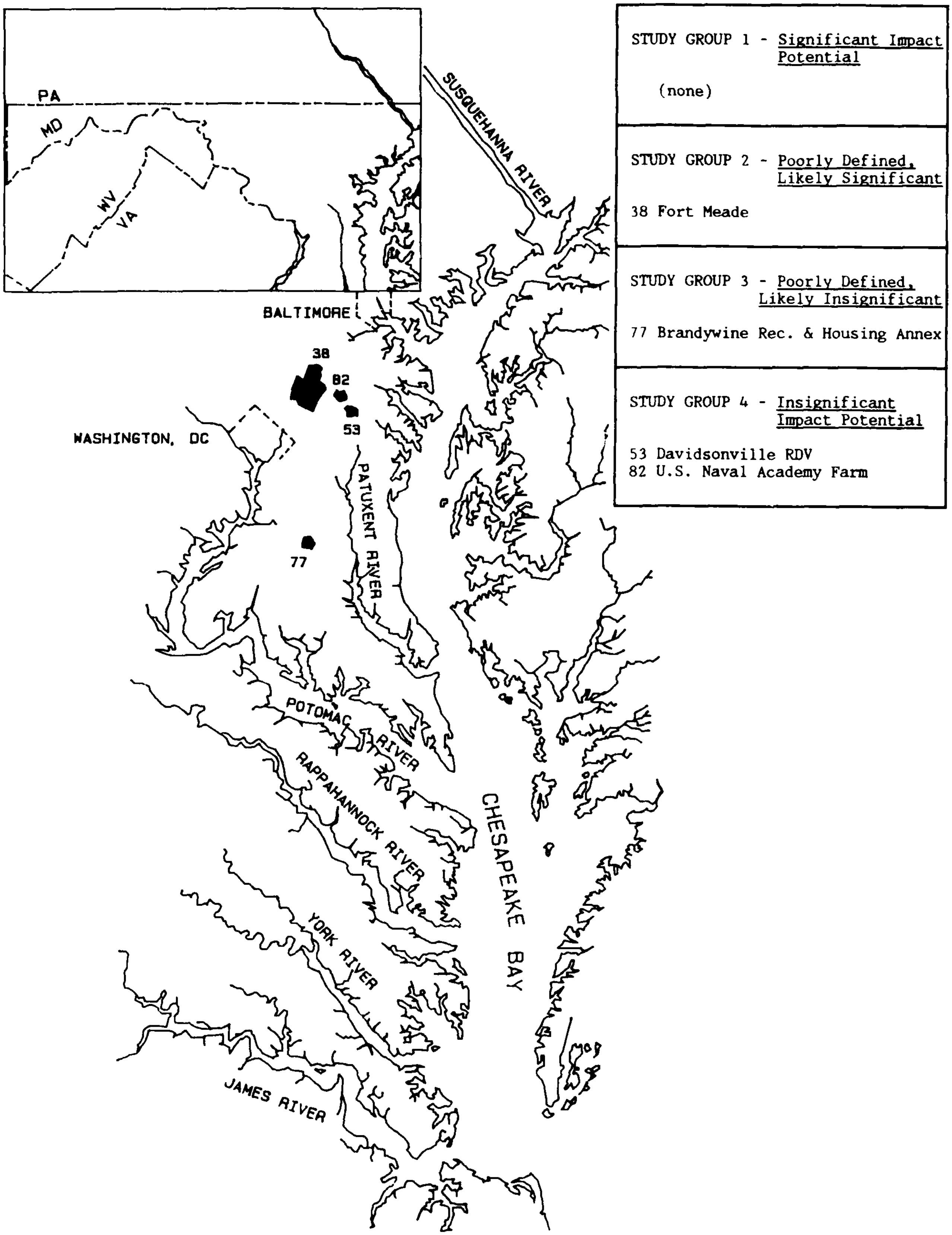


Figure 4.22 Location of DoD Installations in the Non-Tidal Patuxent River Region and Summary of Installation Impact Potential.

Table 4.50 Summary of Final Screening for Installations in the Non Tidal Patuxent River Region

ON-SITE SCREENING CRITERIA (ON-SITE IMPACT POTENTIAL)

ID	Branch	Installation Name	NON-POINT SOURCES: 1. Erosion/Sedimentation	2. Impervious Area Runoff	3. Combined Storm Drains	4. Shoreline Erosion	POINT SOURCES: 5. Sewage Treatment	6. Industrial Waste Treat	7. Intermitt Sewage Treat	HAZARDOUS/TOXIC MATERIALS: 8. Refueling Operations	9. Munitions Operations	10. Chemical Operations	11. Pesticides	12. Vehicle Maintenance	13. Ship Maintenance	14. Solid Waste Disposal	15. Hazardous Waste	16. SPCC Status	17. Abandoned Sites	18. LUST Status	ENVIRONMENTAL PROGRAMS: 19. Forestry Mgmt. Plan	20. Wildlife Mgmt. Plan	21. Soil Conservation Plan	22. Stormwater Mgmt. Plan	23. Wetlands Mgmt. Plan	24. Shoreline Erosion Plan
38	ARMY	Fort Meade	Θ	+	·	·	⊕	-	·	+	+	+	⊕	+	·	+	-	+	Θ	-	⊕	⊕	+	+	⊕	·
82	NAVY	US Naval Academy Farm	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	⊕	+	·	·
53	USAF	Davidsonville RDV	·	·	·	·	·	·	·	·	·	·	·	·	·	-	·	·	·	+	·	·	·	·	-	·
77	USAF	Brandywine RHA	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	-	Θ	·	·	·	·	·	·	·

VICINITY SCREENING CRITERIA / STUDY GROUP

ID	Branch	Installation Name	RELATIONSHIP TO LOCAL ENVIRONMENT: 25. Shellfish Areas	26. SAV Areas	27. Fish Spawning Areas	28. Wetlands Areas	29. Waterfowl Nesting	30. Endangered Species	31. Relative Local Impact	IMPACT POTENTIAL: 1. Significant	2. Poorly Defined, Sig.	3. Poorly Defined, Insig.	4. Insignificant
38	ARMY	Fort Meade	·	·	·	⊕	⊕	+	-		X		
82	NAVY	US Naval Academy Farm	·	·	·	·	·	·	·				X
53	USAF	Davidsonville RDV	·	·	+	+	·	·	+				X
77	USAF	Brandywine RHA	·	·	·	·	·	·	+			X	
		Total Number of Installations per Study Group								0	1	1	2

Score Totals

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
·	3	3	4	4	3	3	3	3	3	3	3	3	3	2	3	2	2	2	3	3	2	2	2	4	4	4	3	2	3	3	1
+	0	1	0	0	0	0	1	1	1	1	0	1	0	1	0	1	0	1	0	0	1	2	0	0	0	0	1	1	0	1	2
⊕	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	1	0	1	0	0	0	0	1	1	0	0
-	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
Θ	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0

KEY: Impact Category 1: { Θ Significant Impact Potential (Adverse)
⊕ Significant Impact Potential (Beneficial)

Impact Category 2: { - Unknown or Poorly Defined Impacts (Adverse)
\+ Unknown or Poorly Defined Impacts (Beneficial)

Impact Category 3: · Insignificant Impact Potential (Adverse or Beneficial)

instituted at this facility to remedy past NPDES violations at two sewage treatment package plants as well as removal of the source of a fuel leak into surface waters. Fort Meade remains in Study Group 2. Areas of concern include questionable quality of industrial wastewater entering the installation STP which discharges to the Patuxent River, potential leachate migration from the existing sanitary landfill, local erosion and sedimentation, and nonconforming hazardous waste disposal practices. Despite these concerns, the impacts of DoD installations on the non-tidal Patuxent River are believed to be minor in comparison to the surrounding activities in this drainage basin. Beneficial activities at DoD installations have included implementation of progressive land management and natural resources plans (Fort Meade), upgrading of sewage treatment systems (Fort Meade, Brandywine RDV), and clean-up of POL and pesticide storage areas (Fort Meade, Davidsonville RDV).

4.13.2 Installation 38: Fort George G. Meade (FGGM)

4.13.2.1 **General**. Fort George G. Meade (FGGM) is located in Anne Arundel County, Maryland, situated approximately equidistant between Baltimore, Md. and Washington, D.C. The northernmost one-third of the installation contains administrative, recreational, and housing facilities, while the remaining portion serves as a training area and a firing and combat range. The total area is approximately 13, 500 acres. The primary mission of FGGM is to provide administrative support and services to tenant units.

4.13.2.2 **Summary of Impact Potentials and Recommended Actions**. In Phase I of this study, FGGM was screened in Study Group 2 based on: chronic erosion problems; STP discharge violations due to pretreatment excesses; leachate migration from the sanitary landfill; and, hazardous waste handling and storage deficiencies.

The installation assessment methodology was applied to FGGM during Phase III to better define the likely character and extent of FGGM's impact on local receiving waters. As a result of the Phase III assessment, Fort Meade remains in Study Group 2. Areas of concern include: continued problems with pretreatment of NSA's industrial wastewater and subsequent effects on STP operations; concern over leachate from the existing sanitary landfill; control over erosion and sedimentation and subsequent effects on sensitive habitat; and, non-conforming hazardous waste disposal practices. In comparison to the Patuxent River basin-wide practices, Fort George G. Meade has a minor effect on surface water quality based on presently available information. However, leachate (surface water and groundwater) from the sanitary landfill has the potential for offsite migration of pollutants but there is presently no data to verify this. There are many beneficial impacts due to recent improvements in FGGM's policies and practices such as: a recently implemented erosion control plan; an active wetlands management program; upgrading of the installation STP; clean-up of POL and pesticide storage areas; and, an upcoming UST testing program and sanitary landfill monitoring program. Table 4.51 summarizes the areas of concern and recommended actions identified for FGGM.

Table 4.51 Summary of Areas of Concern and Recommendation for Fort George G. Meade

ACTIVITY/POLLUTANTS OF CONCERN	ONSITE	OFFSITE/VICINITY	RECOMMENDATIONS	EST. COST
Existing Sanitary Landfill/ pH, chloride, alkalinity, metals	Contamination of ground and surface waters by leachate. Surface water flow is south west toward Little Patuxent River.	Landfill is located adjacent to eastern border of facility; potential exists for offsite migration of contaminants since groundwater flow is to southeast.	Continue monitoring existing wells and surface water sampling sites. Implement USATHEMA study on leachate migration.	Monitoring: $50,000-$100,000 per year Upgrade landfill: $250,000 +
Pretreatment of NSA industrial wastewater/ copper, silver	Plating wastes containing copper excess inhibit biological process of STP therefore causing NPDES violations.	STP effluent excesses affect watershed which is already stressed due to other vicinity STP's.	Examine/modify pretreatment process to avoid negative affects on STP processes.	Upgrades: $200,000 +
Erosion/ sedimentation	Sedimentation problems in holding ponds Wetlands/waterfowl area impacts.	Increases sediment load and constituent concentrations in receiving waters already stressed by urbanization in watershed.	Institute best management practices to control/ inhibit erosion and runoff and create positive wetlands impacts.	Management: $30,000/year (labor)
Hazardous material storage and disposal/ chemicals			Reduce DRMO contracting delays. Implement practices to improve existing nonconforming storage buildings. Hasten construction of conforming storage area now scheduled for 1989.	New storage area: $200,000

Recommended actions for FGGM include:

- o Implementation of best management practices in pre-treating NSA's industrial wastewater;
- o Implementation of best management practices in control of erosion and streamflow improvements to provide positive impacts on land use and wetlands management;
- o Proceed with monitoring program at sanitary landfill (ground and surface water); and
- o Finalize RCRA Part B permit application and institute HM/HW management practices which conform with existing standards.

4.13.3 Installation 82: United States Naval Academy Dairy Farm

4.13.3.1 **General.** The USNA Farm is a modern 825 acre dairy farm located in the rural community of Gambrills, Maryland. The sole mission of the farm is to produce milk for the corps of midshipmen at the USNA. The farm is a self contained operation which produces, processes and packages milk in large quantities. Milk that is not used for the midshipmen is sold creating revenue for the operation. The farm is run using modern soil conservation techniques and has no evidence of significant erosion problems. Manure from the feedlots is collected in a holding pond and disposed of by land application through an extensive irrigation type system. Crops grown on the farm are used for silage. The silage is stored in bins or in a large open pit silo.

4.13.3.2 **Summary of Impact Potential.** The screening data for the USNA Farm are summarized in Tetra Tech (1986). The USNA Farm is a typical, although large, dairy farm using agricultural best management practices to reduce erosion and runoff pollution from animal wastes. As with any operation of its kind there are several observations related to water quality which become apparent. These include:

a. The USNA Diary Farm has constructed a manure lagoon to manage the runoff from its barns and reduce the potential for coliforms to reach local receiving waters. The lagoon is also beneficially used for irrigation purposes. This is the type of agricultural practice that EPA hopes to see throughout the Chesapeake Bay watershed to reduce non-point farm pollution.

b. Leakage or seepage from the large open pit silo has the potential to add nutrients and BOD to the nearby stream.

Although there are some water quality considerations at the USNA Farm they are thought to be insignificant. The farm falls into Study Group 4 (likely insignificant) and therefore was not addressed in detail during Phase III (See also Table 4.50). Recommendations for the USNA Farm relate to

continued use of BMP's for soil conservation and provision of adequate control or treatment of runoff carrying organic material into local streams. The recommended actions are summarized in Chapter 5.

4.13.4 Installation 53: Davidsonville RDV

4.13.4.1 General. The Davidsonville RDV is a remote installation of Andrews Air Force Base and consists of the Davidsonville Transmitter Site and Davidsonville Housing Annex. The transmitter site occupies about 863 acres and is located 30 miles northeast of Andrews AFB off of Maryland Route 424. Communications antennae occupy the majority of the land area. The Patuxent River forms the western boundary of the site which is also drained by Ropers Branch, a tributary of the Patuxent. The housing annex is located about 10 miles southeast of the transmitter site off Maryland Route 214. The mission of the Davidsonville RDV installation is to provide full communications in support of the Defense Communications System and to provide air-to-ground HF communications in support of the President of the United States and other dignitaries.

4.13.4.2 Summary of Impact Potential and Recommended Actions. The screening criteria data for the Davidsonville RDV installation are summarized in Tetra Tech (1986). Based on this information, the installation was screened in Study Group 4, having an insignificant impact potential (see also Table 4.50). This determination is based on the following observations:

a. Small "package plant" type sewage treatment plants provide secondary treatment at both the Davidsonville Transmitter Site and Housing Annex. The effluent from each of these plants is less than 0.010 MGD. The plants are programmed for upgrades in Andrews AFB's master plan, however, funds have not yet been allocated for the project. The plants are not in compliance with State of Maryland regulations for residual chlorine, but since flows are so small, impacts on the local environment are negligible.

b. An unauthorized dump site was used at the transmitter site for disposal of trash, scrap metal, full and empty paint cans, automobiles, and construction rubble. This dump site was located about 100 ft from Ropers Creek and was cleaned up in September 1985 using Defense Environmental Restoration Account funds.

c. In 1984 a fuel oil leak from a 2000 gallon underground tank occurred at the transmitter site. The leak site has since been cleaned up by removing the fuel tank and excavating all visually contaminated soil. Also, four monitoring wells were installed around the leak site. Due to the level of cleanup performed at the leak site, the potential for contaminant migration is small.

d. There are wetlands on the transmitter site which appear to be productive and undisturbed. However, no wetlands management plan

exists to prevent future development in these environmentally sensitive areas.

e. There are American shad spawning areas on the adjacent Patuxent River and there are no evident adverse impacts of the site on these fisheries.

f. The transmitter site has probably had an overall beneficial impact on the local environment since the land otherwise may have been used for agricultural purposes having nonpoint source pollution impact.

Because of its apparent very minor pollutant contributions to the waters of Chesapeake Bay, the Davidsonville RDV was not examined further in Phases III of this study. Recommended actions for the Davidsonville RDV relate to providing a wetlands management plan and upgrading the package sewage treatments plants to ensure NPDES compliance. These recommendations are summarized in Chapter 5.

4.13.5 <u>Installation 77: Brandywine Receiver and Housing Annex (BRHA)</u>

4.13.5.1 **<u>General</u>**. BRHA consists of the Brandywine Receiver Site (1640 acres) and the Brandywine Housing Annex (5 acres) both of which are remote facilities of Andrews Air Force Base. BRHA is located in Prince Georges County, Maryland, about 25 miles southeast of Washington, D.C. Surface runoff from the Receiver Site is directed to two unnamed tributaries of Mattawoman Creek and then to the Potomac River. At the Housing Annex, runoff flows to a tributary of Mataponi Creek which flows to the Patuxent River. The mission of BRHA is to provide air-to-ground HF communications in support of the Andrews Presidential/VIP Radio Station and other agencies.

4.13.5.2 **<u>Summary of Impact Potential and Recommended Actions</u>**. BRHA was screened in Study Group 2 in Phase I of this study based on two sewage treatment package plants that were out of compliance with NPDES permits for meeting dissolved oxygen and residual chlorine limits, a fuel leak at the Housing Annex which had reached a nearby unnamed creek, and a waste accumulation point at the Receiver Site which was visually contaminated with waste oil. The installation assessment methodology was applied to BRHA during Phase III to better define (quantify) the likely character and extent of BRHA's impact on local receiving waters. As a result of this analysis, BRHA has been reassessed and reassigned to Study Group 3 because measures have been instituted at the facilities to remedy the NPDES violations and fuel leak problem. Table 4.52 summarizes the areas of concern and recommended actions identified for BRHA. As shown in this table, areas of concern include continued leaking of fuel oil to the creek from the Housing Annex during rain events; oil contaminated soil at the Receiver Site; and determination of performance of the newly upgraded package plants. No data exist in nearby surface waters to determine the effects of BRHA on local receiving waters, but it is believed that any adverse impacts are very minor. The 1640 acres occupied by the Receiver Site have removed this land

Table 4.52 Summary of Areas of Concern and Recommended Actions for Brandywind Receiver and Housing Annex

ACTIVITY/POLLUTANTS OF CONCERN	ONSITE	OFFSITE/VICINITY	RECOMMENDATIONS	ESTIMATED COST
Former Leaking Underground Storage Tanks (SP-6) / fuel oils	Underground storage tanks at housing annex leaked fuel which reached a nearby unnamed stream. The tanks have been removed but fuel oil is still detected in the stream following rain events.	No water quality monitoring data exist for Mataponi Creek (downstream of BRHA) to indicate elevated levels of petroleum contaminants.	Continued investigation and monitoring of ground and surface water is recommended to determine if fuel oil is floating on water table and if it is feasible to remove oil. Absorbant barriers should remain in place to contain ongoing leaks.	<u>Monitoring</u>: $30,000/year <u>Oil Recovery</u>: $70,000
Waste Oil Disposal Site (WAP-1) / oil contaminated soil	This is a former disposal area for waste vehicle engine oil. Visual inspection shows soil is contaminated. This site was an IRP site, but is now subject of in-house corrective action program.	No surface water quality monitoring data exist for nearby streams to indicate elevated levels of petroleum products.	Continue with in-house corrective action program for this site and remove contaminated soil if warranted.	<u>In-house Plan</u>: $50,000 - $200,000
STP Package Plants / residual chlorine, fecal coliform bacteria	STP package plants at both the Receiver Site and Housing Annex were recently upgraded to correct the residual chlorine and fecal coliform paradox.	Elevated bacteria levels exist in Mattawoman Creek due to failing septic systems and agricultural runoff throughout the watershed.	The performance of the newly upgraded STPs should be monitored to determine if residual chlorine problems have been solved by the new equipment.	<u>Monitoring</u>: $20,000

from potential agricultural use. This is a benefit to local receiving waters because of the elimination of nutrient and bacterial loadings associated with agricultural and farm land. Recommended actions for BRHA include:

- o Continue investigation and monitoring of ground and surface water at the former leaking underground storage tanks at the Housing Annex. These tanks have been removed, but fuel oil is still collected at containment barriers in a nearby creek following rain events. Determine whether fuel is floating on water table and if it is feasible to remove the fuel lens.

- o Remove the contaminated soil at the waste oil disposal area at the Receiver Site.

- o Monitor the performance of the newly upgraded package plants to determine if residual chlorine problems have been solved by the new equipment.

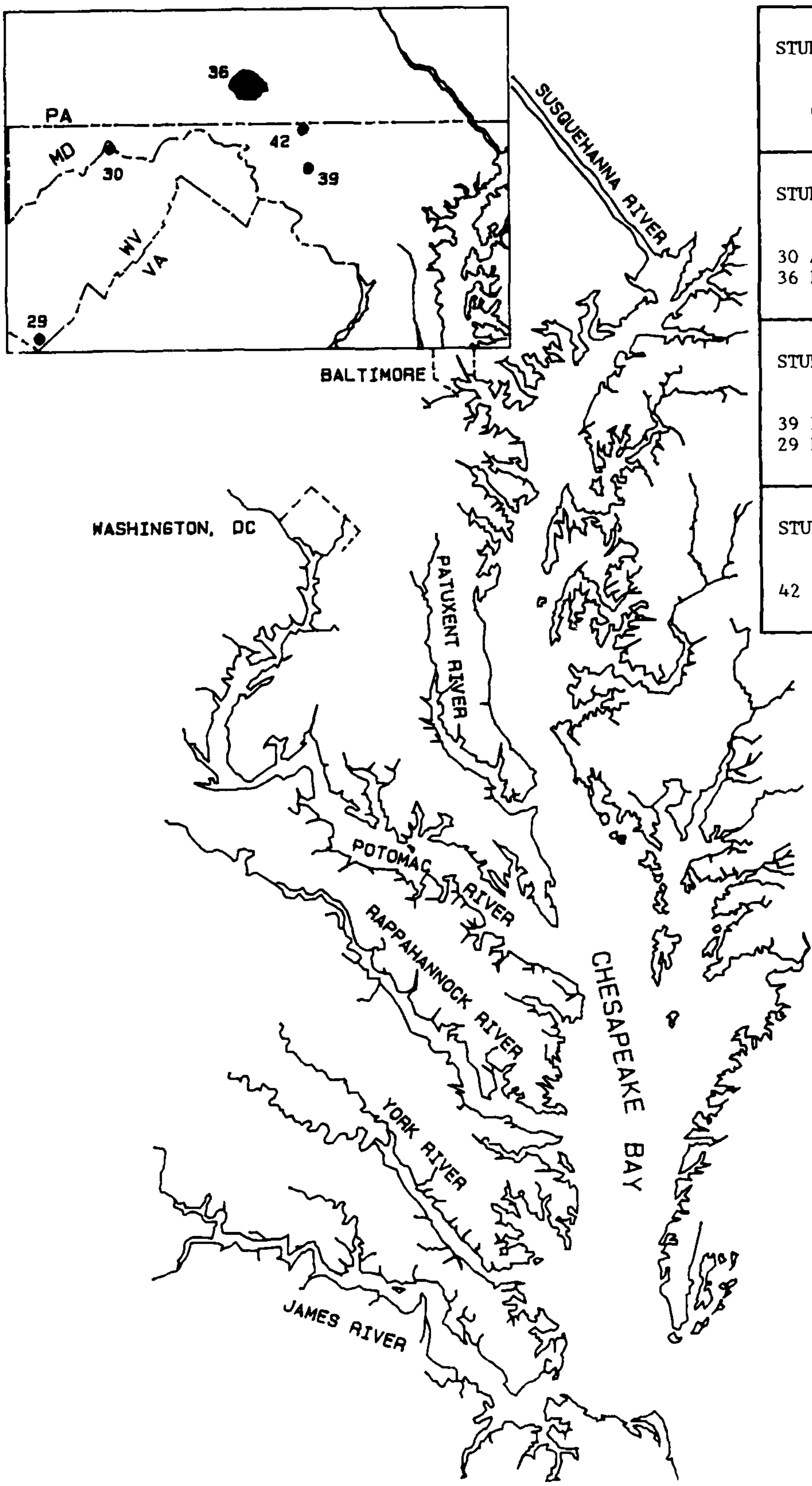
4.14 REGION 13: NON-TIDAL POTOMAC RIVER

4.14.1 Tributary/Regional Description

4.14.1.1 Environmental Setting. The non-tidal Potomac River and its tributaries and branches originate in the Blue Ridge or Appalachian Mountain regions, and flow generally southeasterly through the Piedmont region to the Fall Line at Washington, D.C. (see Figure 4.23). The land is primarily forested or agricultural, with few sizeable urban areas. The waters support the typical biota of the temperate uplands. Generally, water quality is good, with localized problems of acid mine drainage, sewage (bacterial) contamination, or oxygen-demanding organic materials attributed to agricultural runoff. Water quality in much of the North Branch is poor with very low pH levels due to abandoned mine drainages and high bacterial levels due to raw sewage discharges.

Five Department of Defense installations are located on this watershed: the Naval Radio Station at Sugar Grove, WV, on the south fork of the south branch Potomac; Allegany Ballistics Laboratory, near Cumberland, MD, on the Potomac; Letterkenny Army Depot at Chambersburg, PA, on the Conococheage tributary watershed; Fort Ritchie, near Thurmont, MD, at the head of the Monocacy watershed; and, Fort Detrick at Frederick, MD, on the Monocacy River tributary of the Potomac. Although these installations are remote from the Chesapeake estuary, modelling and monitoring studies have shown that the upper Potomac contributes a significant amount of the sediment and heavy metals delivered to the Potomac estuary.

1. Naval Radio Station, Sugar Grove, WV - the installation most remote from the Chesapeake estuary, on the South Fork of the South Branch Potomac river. The region is mountainous, with rivers and indigenous biota characteristic of the Appalachian province. Water quality is generally good.



STUDY GROUP 1 - Significant Impact Potential

(none)

STUDY GROUP 2 - Poorly Defined, Likely Significant

30 Allegany Ballistics Lab
36 Letterkenny Army Depot

STUDY GROUP 3 - Poorly Defined, Likely Insignificant

39 Fort Detrick
29 Naval Radio Station-Sugar Grove

STUDY GROUP 4 - Insignificant Impact Potential

42 Fort Ritchie

Figure 4.23 Location of DoD Installations in the Non-Tidal Potomac River Region and Summary of Installation Impact Potential.

2. Allegany Ballistics Laboratory - proximate to the urban industrial complex on the Potomac near Cumberland, MD. The region is primarily forested, some agriculture, and with problems attendant with acid mine drainage. This reach of the Potomac river has been stressed through various activities, and water quality suffers locally.

3. Letterkenny Army Depot - Letterkenny Army Depot is located in the Cumberland Valley in south central Pennsylvania, near Chambersburg. The installation is primarily woodland, with mainly oak and some other hardwoods. The region is geologically complex, and sinkholes have occurred on the base. The depot is bisected east-west by a ridge, the drainage on the north side flowing through small creeks to Conodogumet Creek, a tributary to the Susquehanna River. The south side of the ridge, through small feeder streams, is tributary to the upper Potomac River drainage, through Cononchocheague Creek. The waters on base support the typical fresh water biota of the region.

4. Fort Ritchie - in the Blue Ridge physiographic province near Thurmont, MD, but at the border with Pennsylvania. The region is primarily forested. This installation is at the headwaters of the Monocacy watershed, a tributary to the Potomac. Water quality in the area is generally good, but there is a minor problem of animal contamination (waterfowl) in a local reservoir. The lower Monocacy is impacted by sediment and nutrients from agricultural runoff.

5. Fort Detrick - in the Piedmont province, in the city of Frederick, MD. The setting is urban, suburban, agricultural, and forested. The installation abuts Carroll Creek and the Monocacy River, about 15 miles upstream from its confluence with the Potomac River. The Monocacy in this reach has experienced water quality problems, some due to agriculture in the area, and some apparently due to activities on the installation.

4.14.1.2 Vicinity Pollutant Loads

Point Sources

There are no major sewage treatment plant discharges into the upper Potomac River system or its tributary creeks, reflecting the relatively rural, agricultural land uses in the surrounding area. Several minor industrial discharges exist and serve food processing, metal finishing, mining, and paper products industries.

Nonpoint Sources

Nonpoint sources in the upper Potomac River include acid mine drainage, erosion and sedimentation, agricultural runoff and urban runoff. Estimated loadings of pollutants entering the Potomac above the Fall Line include:

total nitrogen - 107 tons/day; total phosphorus - 10 tons/day; total suspended solids - 2,500 tons/day; chromium - 0.3 tons/day; lead - 0.3 tons/day; copper 0.26 tons/day; and zinc - 1.0 tons/day (see also Tables 4.14 and 4.15).

4.14.1.3 Relative Comparison to DoD Installation Pollutant Loads

On a regional level, the point source pollutant loadings from the five DoD installations in the upper Potomac River area are relatively insignificant. On a local level, some of the STPs (Letterkenny Army Depot, Fort Detrick) discharge into small tributaries with limited dilution capacity, and therefore proper maintenance of discharge pollutant levels within permit limits is important to maintain adequate local stream quality. In general, the STPs at the DoD installations appear to be well operated and maintained. There have been some difficulties with the Allegany Ballistics Lab STP being out of compliance with permitted limits for BOD, TSS, and fecal coliforms. A recommendation has been identified to address this concern.

For nonpoint sources, DoD installations represent an overall minor contribution based on land surface area in the drainage basin. Nonpoint source concerns have been identified at Letterkenny Army Depot and at Allegany Ballistics Lab (ABL). At Letterkenny, concerns are related to accelerated erosion on several disturbed areas, and runoff of nutrients and pesticides from agriculture outlease areas. At ABL, concerns are related to potential runoff of propellant chemicals from a solid propellant test area located adjacent to the Potomac River. Recommendations have been identified to address these concerns.

4.14.1.4 Summary of DoD Impacts on the Non-Tidal Potomac River. There are five DoD installations located in this region, as shown in Figure 4.23, representing eight percent of the total number of DoD installations in the Chesapeake Bay drainage basin. Three of these installations (NAVRADSTA-Sugar Grove, Fort Ritchie, and Fort Detrick) were estimated during Phase I to represent a likely insignificant impact potential for surface water quality. Letterkenny Army Depot was screened in Study Group 1, and Allegany Ballistics Lab in Study Group 2, and therefore received additional analysis during Phases II and III of the study.

Table 4.53 presents the results of the final screening for the above five installations. Based on the additional analysis during Phase II, Letterkenny Army Depot was reassigned to Study Group 2 (poorly defined but likely significant impact potential), since available data indicated lack of significant impacts to local surface water quality from the contaminant sources known to exist at LEAD. Areas of concern remaining at LEAD include possible existence of toxics in the storm drainage system, erosion from disturbed areas, runoff of nutrients and pesticides from agricultural outlease areas, and significant on and off-post groundwater contamination from several inactive waste disposal sites. The primary beneficial aspect of LEAD's operations relates to the preservation of large areas on the installation as natural (forested) habitat, as this tends to reduce runoff

Table 4.53 Summary of Final Screening for Installations in the Non-Tidal Potomac River Region

ID	Branch	Installation Name	ON-SITE SCREENING CRITERIA (ON-SITE IMPACT POTENTIAL): NON-POINT SOURCES				POINT SOURCES			HAZARDOUS/TOXIC MATERIALS											ENVIRONMENTAL PROGRAMS						VICINITY SCREENING CRITERIA: RELATIONSHIP TO LOCAL ENVIRONMENT							STUDY GROUP: IMPACT POTENTIAL			
			1. Erosion/Sedimentation	2. Impervious Area Runoff	3. Combined Storm Drains	4. Shoreline Erosion	5. Sewage Treatment	6. Industrial Waste Treat	7. Intermitt Sewage Treat	8. Refueling Operations	9. Munitions Operations	10. Chemical Operations	11. Pesticides	12. Vehicle Maintenance	13. Ship Maintenance	14. Solid Waste Disposal	15. Hazardous Waste	16. SPCC Status	17. Abandoned Sites	18. LUST Status	19. Forestry Mgmt. Plan	20. Wildlife Mgmt. Plan	21. Soil Conservation Plan	22. Stormwater Mgmt. Plan	23. Wetlands Mgmt. Plan	24. Shoreline Erosion Plan	25. Shellfish Areas	26. SAV Areas	27. Fish Spawning Areas	28. Wetlands Areas	29. Waterfowl Nesting	30. Endangered Species	31. Relative Local Impact	1. Significant	2. Poorly Defined, Sig.	3. Poorly Defined, Insig.	4. Insignificant
29	NAVY	NAVRADSTA-Sugar Grove	-	-	·	·	-	·	-	·	·	·	·	·	·	-	·	+	·	·	·	+	+	·	·	·	·	·	+	·	·	·	·			X	
30	NAVY	Allegany Ballist. Lab	-	·	·	·	-	·	·	·	-	-	·	·	·	-	-	+	Θ	-	+	·	Θ	·	·	·	·	·	·	·	·	·	-		X		
36	ARMY	Letterkenny Army Dep.	Θ	-	·	·	-	-	-	-	-	-	-	-	·	·	-	-	Θ	-	+	+	-	+	·	·	·	·	·	·	·	·	-		X		
42	ARMY	Fort Ritchie	⊕	·	·	·	⊕	·	·	·	·	·	⊕	·	·	·	+	+	·	·	+	+	⊕	⊕	·	·	·	·	·	·	⊕	·	·				X
39	ARMY	Fort Detrick	-	·	·	·	⊕	·	+	·	·	⊕	+	·	·	+	·	-	-	·	+	+	+	+	·	·	·	·	·	·	·	·	+			X	
		Total Number of Installations per Study Group																																0	2	2	1
Score Totals		·	0	3	5	5	0	4	2	4	3	2	2	4	5	2	2	0	2	3	1	1	0	2	5	5	5	5	4	5	4	5	2				
		+	0	0	0	0	0	0	1	0	0	0	1	0	0	1	1	3	0	0	4	4	2	2	0	0	0	0	1	0	0	0	1				
		⊕	1	0	0	0	2	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0				
		-	0	2	0	0	3	1	2	1	2	2	1	1	0	2	2	2	1	2	0	0	1	0	0	0	0	0	0	0	0	0	2				
		Θ	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0				

KEY: Impact Category 1: { Θ Significant Impact Potential (Adverse)
⊕ Significant Impact Potential (Beneficial)

Impact Category 2: { - Unknown or Poorly Defined Impacts (Adverse)
\+ Unknown or Poorly Defined Impacts (Beneficial)

Impact Category 3: · Insignificant Impact Potential (Adverse or Beneficial)

of sediments, nutrients and pesticides in a region of concentrated agricultural activity.

As a result of the Phase III analysis, Allegany Ballistics Lab (ABL) remains in Study Group 2. Areas of concern at ABL include erosion from a solid propellant test area, lack of an active NPDES permit and recurring violations for TSS and fecal coliforms at the sewage treatment plant, and potential migration of priority pollutants and metals from several inactive waste disposal sites adjacent to the Potomac River. Although no data exist downstream of ABL in the Potomac River, the large dilution capacity of the river is believed adequate to minimize any pollutant loadings from ABL.

4.14.2 Installation 36: Letterkenny Army Depot (LEAD).

4.14.2.1 **General**. Letterkenny Army Depot (LEAD) falls within two major sub-basins of the Chesapeake Bay. Part of the installation drains into the Susquehanna basin and part drains into the Potomac basin. LEAD is located in Franklin County, Pennsylvania, 5 miles north of Chambersburg and covers over 19,520 acres. The principal missions at LEAD are the following: 1) the overhauling, rebuilding, and testing of wheeled and tracked vehicles, 2) the issuing and shipping of Class III chemicals and petroleum, and 3) the storing, maintaining, demilitarizing, and modifying of ammunition.

4.14.2.2 **Summary of Impact Potential and Recommended Action**. In Phase I of this study, LEAD was screened in Study Group 1, based on observed severe erosion and sedimentation from disturbed areas, questionable quality of the effluent from the sanitary and industrial wastewater treatment plants discharging to small streams, and potential migration of contaminated groundwater leachate into surface waters from several inactive hazardous waste disposal sites. The installation assessment methodology was applied to LEAD during Phase II to better define the likely character and extent of LEAD's impact on local receiving waters. As a result of this analysis, LEAD was reassigned to Study Group 2 (poorly defined but likely significant impact potential). This change reflects the finding that LEAD's operations, although not well defined or quantifiable, are apparently not creating significant impacts on surface water quality, as was originally believed to be the case. However, recommendations have been made to verify these findings through the establishment of a monitoring program. Table 4.54 summarizes the areas of concern and recommended actions for LEAD. Areas of concern remaining at LEAD include possible existence of toxics in the storm drainage system, erosion from disturbed areas, runoff of nutrients and pesticides from agricultural outlease areas, and significant on and off-post groundwater contamination originating from several inactive waste disposal sites. The primary beneficial aspect of LEAD's operations relate to the preservation of large areas on the installation as forested (33%), which helps reduce runoff of sediments, nutrients and pesticides in this region of concentrated agricultural activity. Recommended actions for LEAD include:

- Periodic monitoring of the STP and industrial waste treatment plant to ensure compliance with NPDES permit limits;

Table 4.54 Summary of Areas of Concern and Recommended Actions
Letterkenny Army Depot

ACTIVITY/POLLUTANTS OF CONCERN	ONSITE	OFFSITE/VICINITY	RECOMMENDATIONS	EST. COST
Sulfates and phenols in IWTP	Presence of H_2S in areas of low dissolved oxygen. Measured concentrations in IWTP effluent of SO_4 - 418.9 mg/l ave., 793 mg/l max. State criterion = 250 mg/l. Major upgrade to IWTP planned FY88.	Low species diversity in Rowe Run spring where IWTP resurfaces. (Hughey, 1979)	Recommend whole effluent toxicity tests be performed on a periodic basis on the NPDES effluents. Recommend LEAD measure for presence of H_2S in Rowe Run where IWTP effluence resurfaces.	<u>Design/perform effluent/toxicity tests</u>: design: - $20,000 testing: - $50,000 /year <u>Monitor Rowe Run</u>: $20,000/year
Erosion/sedimentation from disturbed areas.	Observed erosion from demolition and burning grounds, as well as agricultural outleases.	Impact probably minimal due to sediment trapping by ponds and man-made lakes on installation.	Recommend LEAD review soil conservation plans to ensure adequate BMPs for erosion/sedimentation protection.	<u>Plan review/update</u>: $25,000 <u>Monitor erosion use of BMPs</u>: $25,000/year (labor)
Nutrients, pesticides from nonpoint sources, especially agricultural	Elevated nutrient and pesticides levels measured in several streams draining installation from agricultural outlease areas.	AEHA (1985) trout study showed no evidence of pesticides in fish tissue	Recommend LEAD monitor application of pesticides in Agricultural Outlease areas. Recommend that specific pesticides be monitored at stream exits from LEAD as part of stream monitoring programs.	<u>Monitor Agri. Outleases</u>:$25,000/ year (labor) <u>Monitor Streams</u>: $50,000/year
Heavy metals in storm-drain sediments, toxics (volatile chlorinated and and aromatic hydrocarbons) in groundwater and surface waters.	Elevated levels of lead and zinc measured in sediments from storm drain. Low levels of organics measured in streams despite high groundwater concentrations.	AEHA trout study (1985) showed no evidence of TCE's in fish tissue. Fish kills have occurred in Rocky Spring Branch periodically last ten years.	Recommend LEAD monitor industrial areas. Rowe Run, SIA, and Rocky Spring Branch for presence of toxics. Also monitor sediments at Storm Sewer outfall.	<u>Develop Program</u>: $30,000 <u>Monitoring</u>: $100,000 - $150,000 per year

- o Due to past detection of metals and toxicants in the storm sewer's aqueous and sediment discharge, continued monitoring, especially under wet weather conditions, is recommended to determine the possible need for control or treatment of storm runoff from the industrial areas.

- o Suspended sediment from LEAD originates primarily from the disturbed areas where demolition and burning take place and from agricultural outleases. While these areas are located somewhat away from the installation boundaries, and the runoff is probably filtered by vegetative cover, it is still desirable where there is construction or disturbance of the soil to provide erosion control structures which mitigate the effects of sedimentation. This appears to be accomplished to a large extent by the various man made lakes on the installation which tend to trap most of the sediment. The lakes may have some siltation problems but it is judged that little sediment leaves the installation boundaries. A re-examination of the natural resources program to ensure adequate BMPs for erosion/sedimentation controls and to improve control of agricultural outleasing practices, specifically application of fertilizer and pesticides, is recommended.

- o Nutrient concentrations (in the form of nitrates and phosphates) leaving the depot are quite high due primarily to the number of agricultural outleases. Elevated pesticide levels have also been detected in streams draining the agricultural areas. Discussions with depot personnel indicate that little monitoring of the agricultural outlease activities occurs to ensure that BMPs for fertilizer and pesticide application are followed. It is recommended that LEAD review the agricultural outlease program to ensure BMPs are implemented.

- o The absence of any statistically valid historical vicinity data precludes the verification of the hypothesis that elevated sulfates, nutrients, suspended and volatile solids, sedimentation, pesticides, toxics, and heavy metal levels found in certain surface water locations have an adverse impact on the stream biota. It is a prudent management practice to perform periodic self monitoring of local receiving waters to ensure that activities on the depot are not creating adverse stresses. This is especially the case where potential problems have been observed in the past. In view of the findings at LEAD, a monitoring program is recommended for all streams exiting LEAD to augment information on pollutants (known and/or suspected) originating on LEAD. Sampling stations, in general, should be located at the LEAD boundary similar to stations monitored by Meuser (1984). Parameters should include conventionals (flow, temperature, BOD, DO, pH, nutrients, turbidity, coliforms), metals, pesticides, and a suite of trace organics. Conventionals and pesticides should be sampled routinely (seasonally). Toxics should be sampled at least annually, as appropriate.

- o Monitoring is also recommended for Rocky Spring Lake and Branch to determine the extent of possible eutrophication conditions. Parameters should include, at the least, flow, temperature, nutrients, BOD, DO, pH, chlorophyll a, and turbidity at the inflow, outflow and two to three locations within the lake. Sampling should occur during summer and early fall conditions.

4.14.3 Installation 39: Fort Detrick

4.14.3.1 **General**. Fort Detrick is located in Frederick County, Maryland, and is approximately 45 miles north of Washington, D.C. The fort covers 1,154 acres of land in two separate tracts of land. The sewage and water treatment plants are also located on separate tracts of land. The primary mission of Fort Detrick is to provide centralized Base Operations Support Services to the facilities and operations of tenant organizations performing medical and bioengineering research and development. Prior to 1970, Fort Detrick was the nation's center for military offensive and defensive biological research.

4.14.3.2 **Summary of Impact Potential**. Fort Detrick's preliminary screening data are presented in Tetra Tech (1986). Based on the screening criteria, Fort Detrick is judged to fall within Study Group 3, a site having a poorly defined but likely insignificant potential impact level on the Chesapeake Bay and associated ecological resources (see Table 4.53). Major considerations for this judgement include the following:

a. Agricultural outleases (217 acres) and pastures for animals are areas for potential nonpoint source problems associated with farming activities.

b. Wastewater generation falls into two types, industrial and sanitary. Industrial wastewater includes all sewage generated in the laboratory buildings and is considered contaminated by infectious waste due to research activities. The wastewater is sterilized by mixing with live steam and heating to 260° F for 20 minutes. After sterilization the effluent enters the sanitary system and combines with all other generated sewage. The sewage treatment plant, as well as the sterilization plant, is divided into parallel operating units to assure constant treatment during maintenance or repair. Sanitary wastewater monitoring occurs 2-3 times per 8 hour shift.

c. Fort Detrick generates less than 100 kg of hazardous waste per month and is designated a small generator. Waste oil generated on the installation is collected in underground storage tanks until sold to a contractor. Solid waste disposal, which includes dewatered dried sludge, is in a permitted sanitary landfill. Incineration of general refuge and pathological waste is permitted. Incinerator ash is also disposed of in the sanitary landfill.

d. Frederick Cancer Research Center (NIH-HHS) is located adjacent to the installation. Fort Detrick provides electricity, steam, domestic wastewater treatment, municipal waste disposal, and road maintenance. The Center provides for its own hazardous waste permit and contract disposal. The Center owns the land.

e. Previous to 1970, mission activities resulted in the burial of chemical, biological, and radioactive waste. Test wells at these old landfill sites (non-confirmation status) were sampled via a priority scan and no migrating plumes were found. Due to the nature of the landfill contents, a potential exists for future impact and a monitoring program will be continued indefinitely.

A recent environmental assessment performed in 1981 concluded that Fort Detrick's missions have been accomplished safely for 38 years using the most stringent safety procedures known. Fort Detrick is in compliance with all environmental regulations. Under normal operations using the "state of the art" and proven safety and operational procedures, it is reasonable to conclude that there is no significant environmental impact. Therefore, Fort Detrick will not be examined further under Phase II and Phase III of this study. Recommended actions for Fort Detrick relate to ensuring use of BMP's for overland erosion control and continued monitoring of potential leachate migration from inactive landfills. Recommended actions are summarized in Chapter 5.

4.14.4 Installation 42: Fort Ritchie

4.14.4.1 General. Fort Ritchie's screening data are summarized in Tetra Tech (1986). Fort Ritchie was screened in Study Group 4, having an insignificant potential impact on the Chesapeake Bay ecological resources (see also Table 4.53). This judgement is based on the following observations:

a. Fort Ritchie has a very effective soil conservation and stormwater management program. There are no reported erosion problems on installation due to a good drainage system combining natural and constructed routes.

b. Domestic wastewater treatment includes rotating biological contactors. There is no generated industrial wastewater. Dried sewage sludge is disposed of at an offsite local landfill.

c. Fort Ritchie implements an effective natural resources program including reforestation and fish stocking.

d. A 1940's impact range is fenced off and closed to the public because of unexploded ordnances. The area has no recorded contamination problems.

Due to the limited potential impact and location, Fort Ritchie did not receive additional examination under Phase III of this study. There are no recommended actions for Fort Ritchie.

4.14.5 Installation 29: Naval Radio Station Sugar Grove (NAVRADSTA)

4.14.5.1 General. NAVRADSTA Sugar Grove is located in the watershed of the South Fork South Branch Potomac River in Pendleton County, West Virginia. The installation consists of two facilities, an operations facility and a support facility, separated by about 6 miles of farmland. The installation lies adjacent to the George Washington National Forest. NAVRADSTA Sugar Grove is a special area of the Naval Communication Area Master Station, Atlantic, at Norfolk, Virginia (NAVCAMS LANT). The mission of the station is to manage, operate, and maintain those facilities and devices necessary to ensure the maintenance of communications with assigned Naval establishments.

4.14.5.2 Summary of Impact Potential and Recommended Actions. The screening data for NAVRADSTA Sugar Grove are given in Tetra Tech (1986). Based on this information, the installation was screened in Study Group 3 since its impacts on the ecological resources of Chesapeake Bay are poorly defined but are likely insignificant (see Table 4.53). This determination is based on the following observations:

a. There are two abandoned landfills at NAVRADSTA Sugar Grove, but they contain very small amounts of hazardous waste and the potential for contaminant migration to surface waters is minimal (NEESA, 1985).

b. NAVRADSTA Sugar Grove is in the process of conducting an active soil conservation program with the West Virginia DNR and this activity should have a beneficial impact on water quality of surface streams in the region. However, an area of special concern for authorities at NAVRADSTA is the immediate implementation of erosion controls around the active construction zone at the operations facility to reduce potential sediment runoff.

c. Surface water streams in the vicinity of NAVRADSTA Sugar Grove are free of pollution except for periodic sedimentation during rainfall events. Water quality of area streams is considered good and fish species include brook trout, darters, and minnows.

Since NAVRADSTA Sugar Grove poses no apparent significant hazards to the local aquatic environment, the site did not receive additional examination under Phase III of this study. Recommended actions for NAVRADSTA relate to use of BMP's for erosion control, and are summarized in Chapter 5.

4.14.6 Installation 30: Allegany Ballistics Laboratory (ABL)

4.14.6.1 **General**. ABL is located on the northwest slope of Knobly Mountain in Mineral County, West Virginia, about 10 miles south of Cumberland, Maryland. The installation is bounded on the west and north by the North Branch Potomac River which is also the state line between Maryland and West Virginia. ABL is drained by several unnamed intermittent streams which discharge directly into the North Branch Potomac River. The installation occupies about 1632 acres of which 1576 are owned by the Navy and 56 acres are owned by Hercules, Inc. ABL is primarily a research, development, and production facility for solid propellant rocket motors. The Aerospace Division of Hercules, Inc., operates ABL under a Facilities Use Contract to the Navy. Although the contract does not specify which party is responsible for obtaining and ensuring compliance with pollution-related permits, there is an unwritten understanding between Naval Sea Systems Command (NAVSEASYSCOM) and Hercules that the latter shall be responsible. Other activities at ABL include research, development, and production of gun propellants and automotive testing. Other than Hercules, there are no other tenant activities at ABL.

4.14.6.2 **Summary of Impact Potential and Recommended Actions**. In Phase I of this study, ABL was screened in Study Group 2, based on the potential for nonpoint source runoff, erosion, and the installation's proximity to the North Branch Potomac River. The installation assessment methodology was applied to ABL during Phase III to better define the likely character and extent of ABL's impact on local receiving waters. As a result of this analysis, ABL remains in Study Group 2. Table 4.55 summarizes the areas of concern and recommended actions identified for ABL. As shown in this table, areas of concern include erosion from a solid propellant test area, lack of an active NPDES permit and recurring violations for TSS and fecal coliforms at the sewage treatment plant, and potential migration of priority pollutants and metals from several inactive waste disposal sites to the North Branch Potomac River. No data exist downstream of ABL to determine the effects of ABL on the North Branch Potomac River, however, the dilution capacity of the river is believed to be quite large, even under low flow conditions. Recommended actions for ABL include:

- With regard to the beryllium landfill (Site 7), coordination with the State of West Virginia DNR regarding this relatively [illegible] landfill has been ongoing since 1980. ABL should continue [illegible] the recently initiated RI/FS (formerly called NACIP [illegible] study) at this site. It is understood that the RI/FS [illegible] prior to initiating any remedial action.

- The hillside behind the rocket test area at the [illegible] corner of ABL has been eroded by rocket engine [illegible] control measures should be implemented in [illegible] soil in storm runoff from entering the North [illegible] It is recommended that an investigation [illegible] the amount of sediment reaching the [illegible]

AD-A190 074 WATER QUALITY ASSESSMENT OF DOD INSTALLATIONS/FACILITIES IN THE CHESAPEAK..(U) TETRA TECH INC ARLINGTON VA NOV 87 DACA31-85-C-0160 4/6

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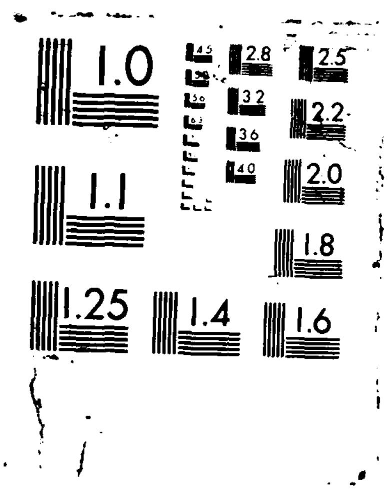
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1.1
1.8
1.25
1.4
1.6

Table 4.55 Summary of Areas of Concern and Recommendations for Allegany Ballistics Laboratory.

Activity/Pollutants of Concern	Onsite	Offsite / Vicinity	Recommendations	Estimated Cost
Solid Propellent Test Area / Sedimentation / propellent chemicals	NEESA (1983) did not find any propellent contamination from soil samples taken in test area	LANTDIV (1986) did not find any propellent contamination in surface water sample SW1 in North Branch Potomac River near test area - samples taken at high flow	Toxic monitoring program for surface drainage from test area. Establish sediment control measures for eroded hillside behind rocket test area.	Monitoring: $50,000 Erosion Control: $100,000
Sewage Treatment Plants / 5-day BOD / Fecal Coliforms / Total Suspended Sediment	DMR data (1986) indicated violations of expired NPDES Permit (S-6557-81) for BOD (1 violation), TSS (2), and Fecal Coliforms (6)	1980-81 STORET data (21MD NBP0326) indicated Fecal Coliform levels of 3700 MPN per 100 ml and minimum pH (6.4) below Maryland state standard of 6.5 (probably due to acid mine drainage)	Review sewage treatment plant operations to solve past violations. Continue to pursue upgrades to STP.	Review Operations: $30,000
NACIP Confirmation Sites / Priority Pollutants / Explosive Compounds / Heavy Metals	LANTDIV (1986) found elevated levels of various pollutants in groundwater	LANTDIV (1986) found low levels of explosive related compounds in two surface water samples taken during high flow in the North Branch Potomac River	Sampling should occur during low flow or average flow conditions. Further study to be completed in final Confirmation Study Round 3. Toxic monitoring program for surface water draining from site.	Confimration Monitoring: $120,000

being the implementation of sediment control measures to prevent eroded soil from reaching the river.

- o Underground storage tanks at ABL are located in the process area which is relatively close to the river. Since the flow direction of the underlying aquifer is toward the river, it is recommended that ABL institute an ongoing UST program to prevent release of oil products to the groundwater via potential leaking underground storage tanks.

- o Treatment operations at the 100,000 GPD sewage treatment plant should be examined to determine the cause of the violations of the Water Pollution Control Permit limitations for 5-day BOD, total suspended solids, and fecal coliform count. Also, all the fecal coliform violations listed in Table 2.2.13.3 occurred in the months of October, November, and December 1986 indicating that the plant may have changed operating procedures. ABL has proposed updating the treatment plant as a part of a capital equipment program recently submitted to NAVSEASYSCOM. If the plant is upgraded, the fecal coliform problem will be resolved.

4.15 LITERATURE CITED

AEHA. 1985. Water Quality Biological Study No. 32-24-0655-85. Evaluation - Contaminated Fish. Letterkenny Army Depot. Chambersburg, Pennsylvania. 10 October 1984 to 2 May 1985. U.S. Army Environmental Hygiene Agency. Aberdeen Proving Ground, Maryland.

AEHA. 1985. Water Quality Engineering Study No. 32-24-1376-85. Evaluation and Monitoring Well and Stream Sampling Data Near the POL Storage Facility. Fort A.P. Hill, Virginia. U.S. Army Environmental Hygiene Agency. Aberdeen Proving Ground, Maryland.

CHESDIV. 1983. Naval Station, Master Plan Update, Annapolis, Maryland. Chesapeake Division. Naval Facilities Engineering Command. U.S. Government Printing Office: 1983 0-424-090:QL2.

CHESDIV. 1985. NACIP Confirmation Study, Naval Ordnance Station, Indian Head, Maryland. Chesapeake Division. Naval Facilities Engineering Command. Washington, D.C. Contract No. N62477-83-C-0238.

Dames & Moore. 1986. Confirmation Study Step 1A (Verification), Round One at Naval Supply Center, Cheatham Annex and Naval Supply Center, Yorktown Fuels Division. Contract No. N62470-85-C-7974. Naval Facilities Engineering Command. Atlantic Division. Norfolk, Virginia.

EPA. 1982. Chesapeake Bay Program Technical Studies: A Synthesis. Chesapeake Bay Program. U.S. Environmental Protection Agency. Washington, D.C.

Garrison, J.S. Ed. 1986. Maryland Water Quality Inventory. A Report on the Progress Toward Meeting the Goals of the Clean Water Act. 1986 Report to EPA According to Section 305(b) Clean Water Act (P.L. 97-117). Office of Environmental Programs. Maryland Department of Health and Mental Hygiene. Baltimore, MD.

Hughey, R.E. 1974. Aquatic Biology Investigation of Letterkenny Army Depot Discharge to Rowe Run, Franklin County, Pennsylvania. 21 November 1973. Environmental Resources Office. Pennsylvania Department of Environmental Resources. Harrisburg, Pennsylvania.

LANTDIV. 1986. Results of Confirmation Study to Determine the Existence and Possible Migration of Specific Chemicals In-Situ. Allegany Ballistics Laboratory, Mineral County, West Virginia. Atlantic Division. Naval Facilities Engineering Command. Norfolk, Virginia.

Macknis, Joeseph. 1986. Personal Communication. U.S. Environmental Protection Agency, Chesapeake Bay Program.

Maryland DNR. 1982. Maryland Water Quality Atlas. Office of Environmental Programs. Maryland Department of Natural Resources. Baltimore, Maryland.

Meuser. J.M. 1984. Environmental Contamination Survey of Letterkenny Army Depot: Multi-phase Investigation Summary. DRXTH-AS-CR-84287. Battelle Project Management Division. Office of Hazardous Waste Management. Richland, Washington.

National Wildlife Federation. 1980.

NAVSEASYSCOM. 1985. Hazardous Materials/Hazardous Waste Management Program Review at NWS-Yorktown. Naval Sea Systems Command.

NEESA. 1983. Initial Assessment Study of Allegany Ballistics Laboratory. Mineral County, West Virginia. Naval Energy and Environmental Support Activity. Port Heuneme, California. NEESA 13-017.

NEESA. 1983. Initial Assessment Study of Naval Supply Center-Craney Island Fuel Terminal, Portsmouth, Virginia. Naval Energy and Environmental Support Activity. Port Heuneme, California. NEESA 13-018.

NEESA. 1984. Initial Assessment Study of Naval Amphibious Base, Little Creek, Norfolk, Virginia. Naval Energy and Environmental Support Activity. Port Heuneme, California. NEESA 13-066.

O'Brien and Gere, Inc. 1984. Correspondence to WASHCOG Regarding Combined Sewer Overflow Loads in the District of Columbia. June 5, 1984.

OEP. 1986. Maryland Water Quality Inventory. A Report on the Progress Toward Meeting the Goals of the Clean Water Act. 1986 Report to EPA According to Section 305(b) Clean Water Act (P.L. 97-117). Garrison, J.S. (ed.). Office of Environmental Programs. Maryland Department of Health and Mental Hygiene. Baltimore, MD.

PADER. 1980. Lower Susquehanna River Basin Water Quality. Pennsylvania Department of Environmental Resources. Bureau of Water Quality Management. Harrisburg, Pennsylvania.

Sturm, S.C and B.J. Neilson. 1977. Water Quality in the York River. A Report to the Hampton Roads Water Quality Agency. Special Report No. 130 in Applied Marine Science and Ocean Engineering. Virginia Institute of Marine Science.

Tetra Tech. 1986. Water Quality Assessment of DoD Installations/Facilities in the Chesapeake Bay Region. Phase I Report. Data Gathering and Installation Screening. Prepared for Baltimore District Corps of Engineers. Contract DACA 31-85-C-0168.

U.S. Army. 1985. Chesapeake Bay Shoreline Erosion Study. Draft Reconnaissance Report. U.S. Army Corps of Engineers. Baltimore and Norfolk Districts.

VEPCO. 1979. Possum Point Power Station Aquatic Monitoring Study. Final Report. Virginia Electric and Power Company. Richmond, VA.

VSWCB. 1986. Virginia Water Quality Assessment 1986. 305(b) Report to EPA Administrator and Congress for the Period July 1, 1983 to June 30, 1985. Information Bulletin 565. Virginia State Water Control Board. Richmond, Virginia. Two Volumes.

WASHCOG. 1985. Potomac River Water Quality - 1984. Conditions and Trends in Metropolitan Washington. Department of Environmental Programs. Metropolitan Washington Council of Governments.

WES. 1978. Draft - Data on Landfill Leachate Quality, Geologic and Hydrologic Characteristics and Revegetation Studies at Landfill Sites. Fort Belvoir, Virginia. Environmental Laboratory. U.S. Army Waterways Experiment Station. Vicksburg, Mississippi.

WES. 1985. Investigation of Fuel Product Above the Water Table in the Vicinity of Storage Tanks 275-277 at Naval Supply Center-Craney Island, Portsmouth, Virginia. U.S. Army Engineer Waterways Experiment Station. Vicksburg, Mississippi.

5.0 SUMMARY OF PHASE III

5.1 INTRODUCTION

This chapter presents a summary of the Phase III analysis as well as a summary of the recommended practices and/or projects to improve water quality conditions at DoD installations throughout the Chesapeake Bay drainage basin. Specifically, the following areas are discussed:

- An update of the Phase I screening process for all 66 installations;
- A ranking of the screening criteria (areas of concern), and discussion of DoD impacts Bay-wide by screening criteria;
- A summary of DoD impacts by Services, region, and Bay-wide; and
- Installation-specific recommended actions, estimated costs, and associated water quality benefits for all 66 installations.

The remaining sections of this chapter address the above areas.

5.2 PHASE I SCREENING UPDATE

One of the primary goals of this study was to move the installations from a "poorly defined" impact category to either a known "significant"* or "insignificant" impact category, based on the comprehensive assessment process described in Chapter 3.0 of this report. To some extent, this goal has been achieved in terms of further identifying and refining the areas of concern (or beneficial practices) on the installations. The purpose of this section is to present an update of the Phase I screening process, through incorporation of the more detailed findings during Phases II and III, for the 37 installations which received additional analysis.

As a brief review, the Phase I preliminary screening methodology assigned the 66 DoD installations under evaluation to one of the following four Study Groups:

Study Group 1. Significant Existing or Potential Impacts (adverse or beneficial);

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* Note: The term "significant", as used in this study, is a relative expression used to compare potential levels of impact on water quality between the 66 DoD installations. The term is not intended to signify the presence of a "statistically significant" impact, as data to show this are generally not available.

Study Group 2. Impact Potential Poorly Defined but Likely Significant (adverse or beneficial);

Study Group 3. Impact Potential Poorly Defined but Likely Insignificant (adverse or beneficial); and

Study Group 4. Insignificant Impact Potential.

Installations screened under Study Groups 1 and 2 received additional focus in Phases II and III of this study. Installations screened under Study Groups 3 and 4 did not receive additional study, however, they have been included in the final Phase III overview and study recommendations, where appropriate.

Presented in Table 5.1 are the updated Phase III screening results for all 66 installations. The names of the installations are listed on the left side of the table along with their corresponding study identification number and Service affiliation. Across the top of the table are the 31 screening criteria, which have been grouped into five categories (i.e., nonpoint sources, point sources, hazardous/toxic materials, environmental programs, and relationship to local environment). Each of these criteria was revisited during the Phase III analysis of the installations. Under each criterion, a symbol score (i.e., $\ominus$, $\oplus$, -, +, ·) has been assigned which indicates the relative impact potential of the installation for that criterion. These symbol scores were obtained according to the guidelines presented in Table 3.4 of this report. It should be noted that the symbol scores do not represent an installation's full level of impact potential. Rather, the level of impact potential and assignment of an installation to a particular Study Group is the result of a review of available on-site and offsite data and information provided by the installation and/or from other DoD or nonDoD sources. For more specific information on a particular installation, the reader is referred to Chapter 4.0 of this report.

To help evaluate the updated screening results, Figures 5.1 and Tables 5.2 and 5.3 have been prepared. Figure 5.1 locates all installations by Study Group in the Bay region. Table 5.2 summarizes the Study Group selections by Service and overall. A total of 15 installations in nine groups have been screened in Study Group 1 (Significant Impact Potential, adverse or beneficial). These include (listed alphabetically):

Installations 34 & 86	Aberdeen Proving Ground (Aberdeen and Edgewood Areas)
Installation 80	Harry Diamond Lab - Blossom Point
Installation 15	Naval Air Station - Oceana
Installations 7 & 8	Naval Air Station/Naval Air Test Center Patuxent River
Installation 5	Naval Ordnance Station - Indian Head
Installation 23	Naval Shipyard - Norfolk
Installation 83	Naval Supply Center - Yorktown
Installation 26	Naval Weapons Station - Yorktown

Table 5.1
Final Screening of the 66 DoD Installations in the Chesapeake Drainage Area[1]

ON-SITE SCREENING CRITERIA (ON-SITE IMPACT POTENTIAL)

ID	Branch	Installation Name[2]	NON-POINT SOURCES: 1. Erosion/Sedimentation	2. Impervious Area Runoff	3. Combined Storm Drains	4. Shoreline Erosion	POINT SOURCES: 5. Sewage Treatment	6. Industrial Waste Treat	7. Intermitt Sewage Treat	HAZARDOUS/TOXIC MATERIALS: 8. Refueling Operations	9. Munitions Operations	10. Chemical Operations	11. Pesticides	12. Vehicle Maintenance	13. Ship Maintenance	14. Solid Waste Disposal	15. Hazardous Waste	16. SPCC Status	17. Abandoned Sites	18. LUST Status	ENVIRONMENTAL PROGRAMS: 19. Forestry Mgmt. Plan	20. Wildlife Mgmt. Plan	21. Soil Conservation Plan	22. Stormwater Mgmt. Plan	23. Wetlands Mgmt. Plan	24. Shoreline Erosion Plan
34	ARMY	Aberdeen Proving Grnd	+	·	-	-	-	+	·	-	θ	θ	+	-	·	·	-	+	θ	-	+	⊕	+	-	+	-
30	NAVY	Allegany Ballist. Lab	-	·	·	·	-	·	·	·	-	-	·	·	·	-	-	+	θ	-	+	·	θ	·	·	·
52	USAF	Andrews AFB	-	-	+	·	·	·	·	-	·	·	+	-	·	·	-	-	-	-	·	·	-	+	·	·
54	USAF	Bolling AFB	·	-	·	·	·	·	·	-	·	·	+	·	·	·	·	-	-	-	·	·	·	-	·	+
78	USAF	Brandywine DRMO	·	·	·	·	·	·	θ	·	·	·	·	·	·	·	-	θ	-	·	·	·	·	·	·	·
77	USAF	Brandywine RHA	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	-	θ	·	·	·	·	·	·	·
43	ARMY	Cameron Station	·	·	·	·	·	·	·	·	·	·	+	·	·	·	-	+	·	-	·	+	+	+	·	·
28	NAVY	Camp Peary	-	·	·	-	+	·	·	·	·	·	·	·	·	-	·	+	·	·	+	·	+	+	+	+
46	ARMY	Carlisle Barracks	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	+	+	·	·
14	NAVY	David Taylor-Annap.	+	-	-	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·
13	NAVY	David Taylor-Carder.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	-	+	·	-	·	·	·	-	·	·
53	USAF	Davidsonville RDV	·	·	·	·	·	·	·	·	·	·	·	·	·	-	·	·	·	+	·	·	·	·	-	·
62	DLA	Defense Gen Sup Ctr.	·	-	·	·	·	·	·	-	·	-	·	-	·	·	-	·	θ	+	·	·	·	-	·	·
47	ARMY	Fort A.P. Hill	θ	·	·	·	-	·	-	-	-	·	+	·	·	+	-	-	θ	-	θ	⊕	θ	·	+	·
48	ARMY	Fort Belvoir	+	-	-	·	·	-	·	-	-	+	+	+	·	+	θ	-	θ	-	+	+	+	θ	+	-

VICINITY SCREENING CRITERIA (RELATIONSHIP TO LOCAL ENVIRONMENT) and STUDY GROUP (IMPACT POTENTIAL*)

ID	Branch	Installation Name[2]	25. Shellfish Areas	26. SAV Areas	27. Fish Spawning Areas	28. Wetlands Areas	29. Waterfowl Nesting	30. Endangered Species	31. Relative Local Impact	1. Significant	2. Poorly Defined, Sig.	3. Poorly Defined, Insig.	4. Insignificant
34	ARMY	Aberdeen Proving Grnd	·	⊕	-	-	⊕	⊕	θ	X			
30	NAVY	Allegany Ballist. Lab	·	·	·	·	·	·	-		X		
52	USAF	Andrews AFB	·	·	-	·	·	·	-		X		
54	USAF	Bolling AFB	·	+	·	·	·	·	-			X	
78	USAF	Brandywine DRMO	·	·	·	·	·	·	·			X	
77	USAF	Brandywine RHA	·	·	·	·	·	·	+			X	
43	ARMY	Cameron Station	·	·	·	·	+	·	+			X	
28	NAVY	Camp Peary	-	-	-	-	-	-	+			X	
46	ARMY	Carlisle Barracks	·	·	·	·	·	·	·				X
14	NAVY	David Taylor-Annap.	-	·	-	·	·	·	+			X	
13	NAVY	David Taylor-Carder.	·	·	·	·	·	·	·				X
53	USAF	Davidsonville RDV	·	·	+	+	·	·	+				X
62	DLA	Defense Gen Sup Ctr.	·	·	·	·	·	·	-		X		
47	ARMY	Fort A.P. Hill	·	·	-	-	⊕	-	·			X	
48	ARMY	Fort Belvoir	·	-	-	-	⊕	-	-		X		

NOTES: 1. Refer to Screening Criteria Guidelines in Volume 2 for definition of scores
2. Installations listed alphabetically
* See also narrative reviews

KEY: Impact Category 1: {
θ Significant Impact Potential (Adverse)
⊕ Significant Impact Potential (Beneficial)

Impact Category 2: {
\- Unknown or Poorly Defined Impacts (Adverse)
\+ Unknown or Poorly Defined Impacts (Beneficial)

Impact Category 3: · Insignificant Impact Potential (Adverse or Beneficial)

Table 5.1 (continued)
Final Screening of the 66 DoD Installations in the Chesapeake Drainage Area[1]

ID	Branch	Installation Name	ON-SITE SCREENING CRITERIA (ON-SITE IMPACT POTENTIAL)																								VICINITY SCREENING CRITERIA							STUDY GROUP			
			NON-POINT SOURCES				POINT SOURCES			HAZARDOUS/TOXIC MATERIALS											ENVIRONMENTAL PROGRAMS						RELATIONSHIP TO LOCAL ENVIRONMENT							IMPACT POTENTIAL*			
			1. Erosion/Sedimentation	2. Impervious Area Runoff	3. Combined Storm Drains	4. Shoreline Erosion	5. Sewage Treatment	6. Industrial Waste Treat	7. Intermitt Sewage Treat	8. Refueling Operations	9. Munitions Operations	10. Chemical Operations	11. Pesticides	12. Vehicle Maintenance	13. Ship Maintenance	14. Solid Waste Disposal	15. Hazardous Waste	16. SPCC Status	17. Abandoned Sites	18. LUST Status	19. Forestry Mgmt. Plan	20. Wildlife Mgmt. Plan	21. Soil Conservation Plan	22. Stormwater Mgmt. Plan	23. Wetlands Mgmt. Plan	24. Shoreline Erosion Plan	25. Shellfish Areas	26. SAV Areas	27. Fish Spawning Areas	28. Wetlands Areas	29. Waterfowl Nesting	30. Endangered Species	31. Relative Local Impact	1. Significant	2. Poorly Defined, Sig.	3. Poorly Defined, Insig.	4. Insignificant
39	ARMY	Fort Detrick	-	·	·	·	⊕	·	+	·	·	⊕	+	·	·	+	·	-	-	·	+	+	+	+	·	·	·	·	·	·	·	·	+			X	
49	ARMY	Fort Eustis	·	·	·	·	-	-	·	-	·	·	·	-	-	Θ	-	·	Θ	-	+	+	·	·	+	·	Θ	·	·	⊕	⊕	·	-		X		
72	ARMY	Fort Lee	·	·	·	·	·	·	+	-	·	·	⊕	·	·	+	·	+	·	·	+	·	+	+	·	·	·	·	·	·	·	·	+				X
44	ARMY	Fort McNair	·	·	·	·	·	·	·	-	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	+				X
38	ARMY	Fort Meade	Θ	+	·	·	⊕	-	·	+	+	+	⊕	+	·	+	-	+	Θ	-	⊕	⊕	+	+	⊕	·	·	·	·	⊕	⊕	+	-		X		
50	ARMY	Fort Monroe	·	·	-	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	+	·	·	·	+	·	·	·				X
45	ARMY	Fort Myer	·	+	-	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	+	+	·	·	·	·	·	·	·	·	·				X
42	ARMY	Fort Ritchie	⊕	·	·	·	⊕	·	·	·	·	·	⊕	·	·	·	+	+	·	·	+	+	⊕	⊕	·	·	·	·	·	·	⊕	·	·				X
51	ARMY	Fort Story	-	·	-	-	·	·	-	-	·	·	·	-	·	·	·	·	·	-	·	·	·	·	+	-	-	·	-	+	+	·	·			X	
35	ARMY	HDL - Adelphi	+	·	·	·	·	+	·	·	·	·	·	·	·	·	+	+	·	-	·	·	+	-	·	·	·	·	·	·	·	·	+			X	
80	ARMY	HDL - Blossom Point	Θ	·	·	Θ	·	·	Θ	·	Θ	·	-	·	·	·	·	+	Θ	-	-	Θ	Θ	·	Θ	Θ	Θ	-	-	Θ	Θ	-	Θ	X			
79	ARMY	HDL - Woodbridge	+	·	·	+	·	·	+	·	·	·	·	·	·	·	·	+	⊕	+	+	⊕	⊕	+	⊕	+	+	·	⊕	⊕	⊕	⊕	+				X
55	USAF	Langley AFB	+	-	·	+	·	·	-	-	·	·	⊕	-	·	·	·	+	-	-	+	·	+	-	·	+	-	·	·	+	+	·	-		X		
36	ARMY	Letterkenny Army Dep.	Θ	-	·	·	-	-	-	-	-	-	-	-	·	·	-	-	Θ	-	+	+	-	+	·	·	·	·	·	·	·	·	-		X		
15	NAVY	Naval Air Sta-Oceana	Θ	-	-	·	·	-	·	Θ	·	·	+	Θ	·	-	-	-	Θ	Θ	+	+	-	Θ	-	·	-	-	·	-	·	·	Θ	X			

NOTES: 1. Refer to Screening Criteria Guidelines in Volume 2 for definition of scores
2. Installations listed alphabetically
* See also narrative reviews

KEY: Impact Category 1: { Θ Significant Impact Potential (Adverse)
⊕ Significant Impact Potential (Beneficial)
Impact Category 2: { - Unknown or Poorly Defined Impacts (Adverse)
\+ Unknown or Poorly Defined Impacts (Beneficial)
Impact Category 3: · Insignificant Impact Potential (Adverse or Beneficial)

Table 5.1 (continued)
Final Screening of the 66 DoD Installations in the Chesapeake Drainage Area[1]

ON-SITE SCREENING CRITERIA (ON-SITE IMPACT POTENTIAL)

ID	Branch	Installation Name[2]	1. Erosion/Sedimentation	2. Impervious Area Runoff	3. Combined Storm Drains	4. Shoreline Erosion	5. Sewage Treatment	6. Industrial Waste Treat	7. Intermitt Sewage Treat	8. Refueling Operations	9. Munitions Operations	10. Chemical Operations	11. Pesticides	12. Vehicle Maintenance	13. Ship Maintenance	14. Solid Waste Disposal	15. Hazardous Waste	16. SPCC Status	17. Abandoned Sites	18. LUST Status	19. Forestry Mgmt. Plan	20. Wildlife Mgmt. Plan	21. Soil Conservation Plan	22. Stormwater Mgmt. Plan	23. Wetlands Mgmt. Plan	24. Shoreline Erosion Plan
			NON-POINT SOURCES				POINT SOURCES			HAZARDOUS/TOXIC MATERIALS											ENVIRONMENTAL PROGRAMS					
6	NAVY	Naval Air Sta-Sol Anx	+	•	•	+	•	•	•	•	•	•	•	•	+	•	•	+	•	•	+	+	+	+	+	+
7	NAVY	Naval Air Sta-Pax Riv	-	-	•	-	•	-	•	θ	-	•	+	-	•	-	-	-	θ	-	+	⊕	+	-	+	+
16	NAVY	Naval Amphibious Base	•	-	-	•	•	•	•	-	•	•	+	•	θ	•	+	-	θ	-	+	+	•	-	-	+
85	NAVY	Naval Com. Unit	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	+	•	•	-	•	•	•	•
11	NAVY	Naval Elect. Sys Eng	+	•	•	+	+	•	•	•	•	•	•	•	•	•	•	•	•	•	+	+	+	+	+	+
12	NAVY	Naval Med. Com-NCR	⊕	•	-	•	•	-	•	-	•	•	•	•	•	•	-	-	•	•	•	•	•	-	•	•
84	NAVY	Naval Observatory	•	•	•	•	•	•	•	•	•	•	+	•	•	•	•	•	•	•	+	⊕	•	•	•	•
5	NAVY	Naval Ordnance Sta.	•	•	θ	θ	+	-	•	•	θ	•	•	•	•	•	+	+	θ	•	+	+	•	•	+	-
29	NAVY	NAVRADSTA-Sugar Grove	-	-	•	•	-	•	-	•	•	•	•	•	•	-	•	+	•	•	•	+	+	•	•	•
33	NAVY	Naval Research Lab	•	-	•	+	•	-	•	•	•	•	+	•	•	•	+	+	•	•	•	•	+	+	•	+
9	NAVY	Naval Res Lab-CB Det.	•	•	•	-	⊕	•	•	•	•	•	•	•	•	•	•	+	-	•	+	+	+	+	+	+
23	NAVY	Naval Shipyard-Norflk	•	-	•	•	•	θ	•	•	•	θ	•	•	θ	θ	θ	-	θ	-	•	•	•	-	-	•
3	NAVY	Naval Station-Annap.	+	•	•	+	+	•	•	•	•	•	•	•	-	•	•	•	•	•	+	⊕	+	•	+	-
27	NAVY	Naval Sup Ctr-Cht Anx	-	-	•	-	+	•	+	-	•	•	•	•	•	•	•	-	θ	•	+	+	+	+	+	+
22	NAVY	Naval Sup Ctr-Craney	•	•	•	+	•	⊕	•	-	•	•	•	•	•	-	-	-	θ	θ	+	-	•	θ	-	+

VICINITY SCREENING CRITERIA — RELATIONSHIP TO LOCAL ENVIRONMENT; STUDY GROUP — IMPACT POTENTIAL*

ID	Branch	Installation Name[2]	25. Shellfish Areas	26. SAV Areas	27. Fish Spawning Areas	28. Wetlands Areas	29. Waterfowl Nesting	30. Endangered Species	31. Relative Local Impact	1. Significant	2. Poorly Defined, Sig.	3. Poorly Defined, Insig.	4. Insignificant
6	NAVY	Naval Air Sta-Sol Anx	-	-	-	-	-	-	•			X	
7	NAVY	Naval Air Sta-Pax Riv	-	-	-	-	+	+	θ	X			
16	NAVY	Naval Amphibious Base	θ	•	•	θ	•	•	-		X		
85	NAVY	Naval Com. Unit	•	•	•	⊕	•	•	•				X
11	NAVY	Naval Elect. Sys Eng	+	-	-	+	+	+	•			X	
12	NAVY	Naval Med. Com-NCR	•	•	•	•	•	•	-			X	
84	NAVY	Naval Observatory	•	•	•	•	•	•	•				X
5	NAVY	Naval Ordnance Sta.	•	-	-	-	•	•	θ	X			
29	NAVY	NAVRADSTA-Sugar Grove	•	•	+	•	•	•	•			X	
33	NAVY	Naval Research Lab	•	•	-	•	•	•	•			X	
9	NAVY	Naval Res Lab-CB Det.	+	•	•	•	•	•	+			X	
23	NAVY	Naval Shipyard-Norflk	•	•	-	θ	•	•	θ	X			
3	NAVY	Naval Station-Annap.	-	•	-	+	•	•	+			X	
27	NAVY	Naval Sup Ctr-Cht Anx	-	-	-	-	-	-	-		X		
22	NAVY	Naval Sup Ctr-Craney	θ	•	-	-	-	•	-		X		

NOTES: 1. Refer to Screening Criteria Guidelines in Volume 2 for definition of scores
2. Installations listed alphabetically
* See also narrative reviews

KEY: Impact Category 1: { θ Significant Impact Potential (Adverse); ⊕ Significant Impact Potential (Beneficial)
Impact Category 2: { - Unknown or Poorly Defined Impacts (Adverse); + Unknown or Poorly Defined Impacts (Beneficial)
Impact Category 3: • Insignificant Impact Potential (Adverse or Beneficial)

Table 5.1 (continued)
Final Screening of the 66 DoD Installations in the Chesapeake Drainage Area[1]

ON-SITE SCREENING CRITERIA (ON-SITE IMPACT POTENTIAL): NON-POINT SOURCES (1–4); POINT SOURCES (5–7); HAZARDOUS/TOXIC MATERIALS (8–18); ENVIRONMENTAL PROGRAMS (19–24)

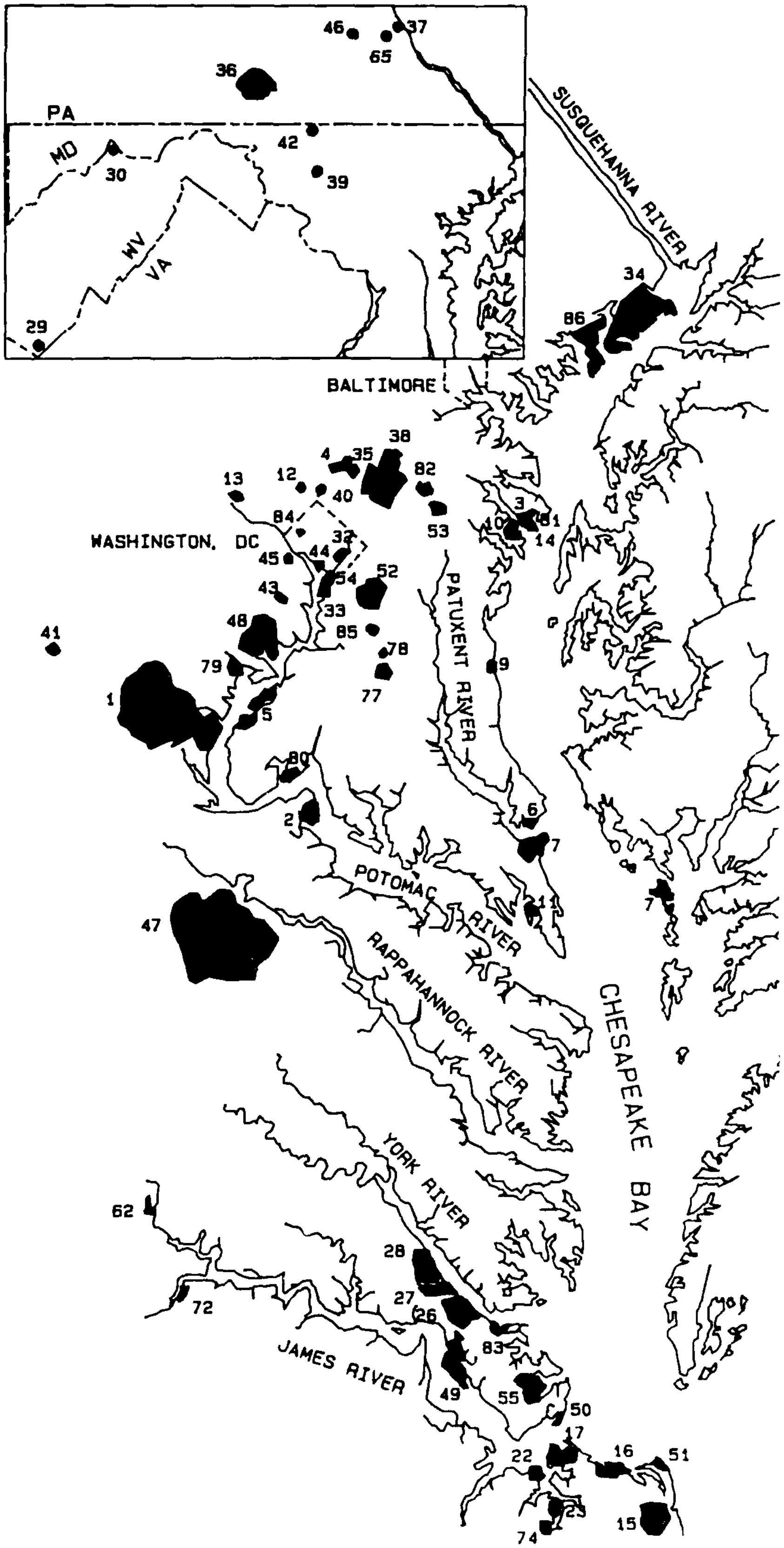
ID	Branch	Installation Name[2]	1. Erosion/Sedimentation	2. Impervious Area Runoff	3. Combined Storm Drains	4. Shoreline Erosion	5. Sewage Treatment	6. Industrial Waste Treat	7. Intermitt Sewage Treat	8. Refueling Operations	9. Munitions Operations	10. Chemical Operations	11. Pesticides	12. Vehicle Maintenance	13. Ship Maintenance	14. Solid Waste Disposal	15. Hazardous Waste	16. SPCC Status	17. Abandoned Sites	18. LUST Status	19. Forestry Mgmt. Plan	20. Wildlife Mgmt. Plan	21. Soil Conservation Plan	22. Stormwater Mgmt. Plan	23. Wetlands Mgmt. Plan	24. Shoreline Erosion Plan
83	NAVY	Naval Sup Ctr-Yorktwn	·	·	·	·	·	·	-	-	·	·	·	·	·	·	·	+	θ	θ	·	·	·	θ	θ	·
2	NAVY	Nav Sur Wea Ctr-Dahl.	+	-	-	+	+	-	·	-	θ	-	+	·	·	·	+	+	θ	·	+	+	+	+	+	+
4	NAVY	Nav Sur Wea Ctr-W Oak	-	-	·	·	+	-	-	·	·	·	+	·	·	·	+	+	-	·	+	+	+	-	·	·
26	NAVY	Naval Weapons Station	·	·	·	·	·	+	·	+	+	+	·	+	·	-	-	-	θ	-	+	+	+	·	-	·
65	NAVY	Navy SPCC	·	-	·	·	·	·	-	-	·	·	·	·	·	·	·	+	-	-	·	·	·	-	·	·
37	ARMY	New Cumberland Depot	·	+	·	·	+	θ	·	+	·	⊕	·	·	·	·	+	+	+	·	·	+	+	+	⊕	·
81	NAVY	Nav Rad Trn Fac-Annap	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·
17	NAVY	Sewells Pt Navy Compx	·	θ	θ	·	·	+	·	θ	·	-	·	-	θ	·	-	-	-	-	·	·	·	-	·	·
74	NAVY	St. Juliens Cr. Annex	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	-	·	·	·	·	·	+	·
1	NAVY	USMC - Quantico	-	-	θ	·	+	·	·	⊕	·	·	·	+	·	⊕	-	⊕	θ	-	⊕	+	-	-	-	·
10	NAVY	US Naval Academy	·	-	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	+	+	-	+	·
82	NAVY	US Naval Academy Farm	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	⊕	+	·	·
41	ARMY	Vint Hill Farms Sta.	·	·	·	·	θ	-	·	·	·	·	·	⊕	·	θ	+	-	θ	-	+	·	+	+	·	·
40	ARMY	Walter Reed Med Ctr.	-	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	-	·	·	·	+	+	·	·
32	NAVY	Washington Navy Yard	·	-	·	·	·	·	·	-	·	·	-	·	·	·	·	-	·	-	·	·	-	+	·	+

VICINITY SCREENING CRITERIA: RELATIONSHIP TO LOCAL ENVIRONMENT (25–31); STUDY GROUP: IMPACT POTENTIAL*

ID	Installation Name[2]	25. Shellfish Areas	26. SAV Areas	27. Fish Spawning Areas	28. Wetlands Areas	29. Waterfowl Nesting	30. Endangered Species	31. Relative Local Impact	1. Significant	2. Poorly Defined, Sig.	3. Poorly Defined, Insig.	4. Insignificant
83	Naval Sup Ctr-Yorktwn	-	-	-	θ	-	·	θ	X			
2	Nav Sur Wea Ctr-Dahl.	-	-	-	-	-	-	-		X		
4	Nav Sur Wea Ctr-W Oak	·	·	-	·	·	·	-		X		
26	Naval Weapons Station	-	-	-	-	-	·	θ	X			
65	Navy SPCC	·	·	·	·	·	·	-		X		
37	New Cumberland Depot	·	·	·	⊕	⊕	·	+			X	
81	Nav Rad Trn Fac-Annap	-	·	-	+	·	·	+				X
17	Sewells Pt Navy Compx	-	·	-	·	·	·	-	X			
74	St. Juliens Cr. Annex	·	·	-	-	·	·	·			X	
1	USMC - Quantico	·	-	-	-	⊕	⊕	+		X		
10	US Naval Academy	-	·	-	-	·	·	·				X
82	US Naval Academy Farm	·	·	·	·	·	·	·				X
41	Vint Hill Farms Sta.	·	·	·	·	·	·	-		X		
40	Walter Reed Med Ctr.	·	·	·	·	·	·	·			X	
32	Washington Navy Yard	·	·	-	·	·	·	·			X	

NOTES: 1. Refer to Screening Criteria Guidelines in Volume 2 for definition of scores
2. Installations listed alphabetically
* See also narrative reviews

KEY: Impact Category 1: { θ Significant Impact Potential (Adverse); ⊕ Significant Impact Potential (Beneficial)
Impact Category 2: { - Unknown or Poorly Defined Impacts (Adverse); + Unknown or Poorly Defined Impacts (Beneficial)
Impact Category 3: · Insignificant Impact Potential (Adverse or Beneficial)



STUDY GROUP 1
34,86 Aberdeen Proving Ground
80 Harry Diamond Lab-Blossom Point
15 Naval Air Station - Oceana
7,8 NAS/NATC - Patuxent River
5 Naval Ordnance Sta.-Indian Head
23 Naval Shipyard - Norfolk
83 Naval Supply Center - Yorktown
26 Naval Weapons Station-Yorktown
17-21 Sewells Point Naval Complex

STUDY GROUP 2
30 Allegany Ballistics Lab
52 Andrews Air Force Base
62 Defense General Supply Center
48 Fort Belvoir
49 Fort Eustis
38 Fort Meade
55 Langley Air Force Base
36 Letterkenny Army Depot
16 Naval Amph. Base - Little Creek
27 Naval Sup. Cen.-Cheatham Annex
22 Naval Sup. Cen. - Craney Island
2 NSWC - Dahlgren
4 NSWC - White Oak
65 Navy Ships Parts Control Center
1 USMC/MCDEC - Quantico
41 Vint Hill Farms Station

STUDY GROUP 3
54 Bolling Air Force Base
78 Brandywine DRMO
77 Brandywine Rec. & Housing Annex
43 Cameron Station
28 Camp Peary
14 David Taylor NSRDC - Annapolis
47 Fort A.P. Hill
39 Fort Detrick
51 Fort Story
35 Harry Diamond Lab - Adelphi
6 Naval Air Sta. - Solomons Annex
11 Naval Elect. Sys. Engr. Act.
12 Naval Medical Command - NCR
29 Naval Radio Station-Sugar Grove
33 Naval Research Lab - Wash., DC
9 Naval Research Lab - CBD
3 Naval Station - Annapolis
37 New Cumberland Army Depot
74 St. Juliens Creek Annex
40 Walter Reed Army Medical Center
32 Washington Navy Yard

STUDY GROUP 4
46 Carlisle Barracks
13 David Taylor NSRDC - Carderock
53 Davidsonville RDV
72 Fort Lee
44 Fort McNair
50 Fort Monroe
45 Fort Myer
42 Fort Ritchie
79 Harry Diamond Lab - Woodbridge
85 Naval Communications Unit
84 Naval Observatory - Wash., DC
81 Naval Radio Transmit. Facility
10 U.S. Naval Academy
82 U.S. Naval Academy Dairy Farm

Figure 5.1 Locations of all 66 DoD Installations in the Chesapeake Bay Region.

Table 5.2 Summary of Study Group Categories by Serivce and Overall

Category	ALL	NAVY	ARMY	USAF	DLA
1. Significant Impact Potential	15	12	3	0	0
2. Poorly Defined, Likely Significant	16	8	5	2	1
3. Poorly Defined, Likely Insignificant	21	11	7	3	0
4. Insignificant	14	6	7	1	0
Totals	66	37	22	6	1

Table 5.3 Summary of On-Site and Vicinity Criteria Scores for All Installations

On-Site Screening Criteria	·	+	-	⊕	Θ
1. Erosion/Siltation	32	10	11	2	5
2. Impervious Area Runoff	35	4	20	0	1
3. Combined Storm Drains	45	2	10	0	3
4. Shoreline Erosion	44	8	6	0	2
5. Sewage Treatment	40	9	6	4	1
6. Industrial Waste Treatment	41	4	12	2	1
7. Intermittent Sewage Treatment	45	5	8	0	2
8. Refueling Operations	33	3	20	1	3
9. Munitions Operations	49	2	5	0	4
10. Chemical Operations	48	3	5	2	2
11. Pesticides	38	15	3	4	0
12. Vehicle Maintenance	45	4	9	1	1
13. Ship Maintenance	54	1	2	0	3
14. Solid Waste Disposal	43	5	8	1	3
15. Hazardous Waste	31	9	18	0	2
16. SPCC Status	15	25	18	1	1
17. Abandoned Sites	24	2	11	1	22
18. UST Status	30	3	24	0	3
19. Forestry Management Plan	29	27	1	2	1
20. Wildlife/Habitat Management Plan	30	20	2	7	1
21. Soil Conservation Program	23	26	5	3	3
22. Stormwater Management Plan	20	21	14	1	4
23. Wetlands Management Plan	30	18	7	3	2
24. Shoreline Erosion Plan	38	16	5	0	1

Vicinity Screening Criteria	·	+	-	⊕	Θ
25. Shellfish Areas	38	3	15	0	4
26. SAV Areas	44	1	14	1	0
27. Fish Spawning Areas	29	2	28	1	0
28. Wetland Areas	27	6	16	7	4
29. Waterfowl	37	5	8	9	1
30. Endangered Species	47	3	7	3	0
31. Relative Local Impact	19	15	18	0	8

Key:
- Θ Significant Impact Potential (Adverse)
- ⊕ Significant Impact Potential (Beneficial)
- \- Unknown or Poorly Defined Impacts (Likely Adverse)
- \+ Unknown or Poorly Defined Impacts (Likely Beneficial)
- · Insignificant Impact Potential

Installations 17, 18, 19, 20, 21:	Sewells Point Navy Complex (Naval Station, Naval Air Station, Naval Rework Facility, Public Works Center, Naval Supply Center)

Similarly, 16 installations in 16 groups have been screened in Study Group 2 (Poorly Defined but Likely Significant Impact Potential). These include (listed alphabetically):

Installation 30	Allegany Ballistics Lab
Installation 52	Andrews Air Force Base
Installation 62	Defense General Supply Center - Richmond
Installation 48	Fort Belvoir
Installation 49	Fort Eustis
Installation 38	Fort George G. Meade
Installation 55	Langley Air Force Base
Installation 36	Letterkenny Army Depot
Installation 16	Naval Amphibious Base - Little Creek
Installation 27	Naval Supply Center - Cheatham Annex
Installation 22	Naval Supply Center - Craney Island
Installation 2	Naval Surface Weapons Center - Dahlgren
Installation 4	Naval Surface Weapons Center - White Oak
Installation 65	Navy Ships Parts Control Center - Mechanicsburg
Installation 1	U.S. Marine Corps - Quantico
Installation 41	Vint Hill Farms Station

The remaining 35 installations in Study Groups 3 and 4 were estimated to have a likely insignificant impact potential on surface water quality. These installations are listed and located in Figure 5.1. Table 5.3 summarizes the criterion symbol scores for each of the 31 screening criteria. Note that the maximum possible score is 60, even though there are 66 installations. This is due to the grouping of multiple installations for three cases, i.e., two at Aberdeen Proving Ground, two at Naval Air Station (Patuxent), and five at the Sewells Point Naval Complex. The table can be used to help identify areas of concern as well as successful programs or practices at DoD installations. For example, the highest frequency of scores (22) under significant adverse impact potential "Θ" occurred under criterion number 17 (Abandoned Sites). Thus, pollutant impact potential from abandoned hazardous waste sites has been identified as a priority area for future evaluation. Likewise, the highest frequency of scores (9) under significant beneficial impact potential "⊕" occurred under criterion number 29 (Waterfowl Nesting). This indicates that many DoD installations benefit the environment by providing desirable waterfowl nesting habitats.

5.3 RANKING OF SCREENING CRITERIA/AREAS OF CONCERN

To help interpret the final screening results and to aid in prioritizing recommended actions to improve DoD practices and programs in the

Chesapeake Bay drainage basin, an approximate ranking of the screening criteria has been prepared. This ranking is based on the frequency of "adverse" symbol scores (i.e., Θ or -) for all installations, multiplied by an impact "priority level" of one or two, with two representing an activity involving the direct discharge of pollutants to receiving waters. Table 5.4 presents the scoring procedure for rank determination. Columns one through five in Table 5.4 present, for criteria 1 through 24, the distribution of criterion symbol scores for all installations involved in this study. The number in column six results from the addition of the two adverse symbol scores "Θ" and "-" from columns three and five. In column seven, a priority level is assigned to each criterion in the following manner. Each criterion is set equal to one. If the criterion involves the direct discharge of pollutant(s) to surface waters, the priority level is doubled. The "Ranking Score" in column eight results from the multiplication of column six by column seven. Based on these ranking scores, Table 5.5 has been developed which ranks the on-site criteria in order from highest to lowest according to the ranking score. The highest ranked criteria (i.e., Abandoned Sites, Impervious Area Runoff, Erosion/Siltation, Combined Storm Drains, Industrial Waste Treatment) reflect the most frequently occurring areas of concern that also tend to involve direct discharges of pollutants to surface waters.*

Of the top six ranked areas of concern at military installations, five relate primarily to activities that are difficult to control or regulate. They include: stormwater runoff; surface erosion; dispersed, intermittent sources of industrial (toxic) pollutants to sewage treatment systems and/or to storm drains (which are permitted and tested only for conventional pollutants); and abandoned or inactive hazardous waste disposal sites that have the potential for leachate migration to surface waters.

It is noted that the environmental programs represented by criteria 19 through 24 are ranked separately in Tables 5.4 and 5.5. These activities reflect environmental management policies and procedures rather than the actual levels of pollutant loading associated with criteria 1 through 18.

Also shown in Table 5.4 are the same screening criteria ranked on the basis of the frequency of "beneficial" symbol scores (i.e., Θ or "+" from columns two and four. The "beneficial" score in column ten results from the multiplication of column seven (priority level) times the sum of columns two and four. In column eleven, a ranking level is assigned to each criterion based on the "beneficial" score in column 10. As shown in Table 5.6, the highest ranked criteria (i.e., SPCC status, Erosion/Siltation, Sewage Treatment, Pesticides, Shoreline Erosion, Industrial Waste Treatment, Intermittent Sewage Treatment, Hazardous

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* Note: Criterion 18 - UST Status - ranked 4th overall primarily due to the frequency of occurrence as an area of concern, but usually does not represent a direct impact on surface waters.

Table 5.4 Criteria Ranking System

On-Site Screening Criteria	Symbol Scores*					Columns (3) + (5)	Priority** Level	Adverse		Beneficial	
	·	+	-	⊕	θ			Ranking Score Columns (6) x (7)	Rank	Ranking Score Columns (7) x (2+4)	Rank
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1. Erosion/Siltation	32	10	11	2	5	16	2	32	3	24	3
2. Impervious Area Runoff	36	4	20	0	1	21	2	42	2	8	9
3. Combined Storm Drains	45	2	10	0	3	13	2	26	5	4	14
4. Shoreline Erosion	44	8	6	0	2	8	2	16	11	16	5
5. Sewage Treatment	40	9	6	4	1	7	2	14	12	26	2
6. Industrial Waste Treatment	41	4	12	2	1	13	2	26	6	12	6
7. Intermittent Sewage Treatment	45	5	8	0	2	10	2	20	9	10	7
8. Refueling Operations	33	3	20	1	3	23	1	23	7	4	15
9. Munitions Operations	49	2	5	0	4	9	1	9	16	2	17
10. Chemicals Operations	48	3	5	2	2	7	1	7	17	5	12
11. Pesticides	38	15	3	4	0	3	1	3	18	19	4
12. Vehicle Maintenance	45	4	9	1	1	10	1	10	15	5	13
13. Ship Maintenance	54	1	2	0	3	5	2	10	14	2	18
14. Solid Waste Disposal	43	5	8	1	3	11	1	11	13	6	10
15. Hazardous Waste	31	9	18	0	2	20	1	20	8	9	8
16. SPCC Status	15	25	18	1	1	19	1	19	10	26	1
17. Abandoned Sites	24	2	11	1	22	33	2	66	1	6	11
18. UST Status	30	3	24	0	3	27	1	27	4	3	16
19. Forestry Management Plan	29	27	1	2	1	2	1	2	6	29	5
20. Wildlife/Habitat Management Plan	30	20	2	7	1	3	1	3	5	27	6
21. Soil Conservation Program	23	26	5	3	3	8	2	16	3	58	1
22. Stormwater Management Plan	20	21	14	1	4	18	2	36	1	44	2
23. Wetlands Management Plan	30	18	7	3	2	9	2	18	2	42	3
24. Shoreline Erosion Plan	38	16	5	0	1	6	2	12	4	32	4

*Key:
- θ Significant Impact Potential (Adverse)
- ⊕ Significant Impact Potential (Beneficial)
- \- Unknown or Poorly Defined Impacts (Likely Adverse)
- \+ Unknown or Poorly Defined Impacts (Likely Beneficial)
- · Insignificant Impact Potential

**Priority Levels - start at "1"
- add 1 if involves direct discharge of pollutants to surface waters

Table 5.5 Ranking of On-Site Criteria by Frequency of Adverse Score

Criterion No.	Criterion	Ranking Score*	Rank
Point, Nonpoint Sources, Hazardous/Toxic Materials (Ranked Separately)			
17	Abandoned Sites	66	1
2	Impervious Area Runoff	42	2
1	Erosion/Siltation	32	3
18	UST Status	27	4
3	Combined Storm Drains	26	5
6	Industrial Waste Treatment	26	6
8	Refueling Operations	23	7
15	Hazardous Waste	20	8
7	Intermittent Sewage Treatment	20	9
16	SPCC Status	19	10
4	Shoreline Erosion	16	11
5	Sewage Treatment	14	12
14	Solid Waste Disposal	11	13
13	Ship Maintenance	10	14
12	Vehicle Maintenance	10	15
9	Munitions Operations	9	16
10	Chemical Operations	7	17
11	Pesticides	3	18
Environmental Programs (Ranked Separately)			
22	Stormwater Management Plan	36	1
23	Wetlands Management Plan	18	2
21	Soil Conservation Program	16	3
24	Shoreline Erosion Plan	12	4
20	Wildlife/Habitat Management	3	5
19	Forestry Management Plan	2	6

* See Table 5.4

Table 5.6 Ranking of On-Site Criteria by Frequency of Beneficial Score

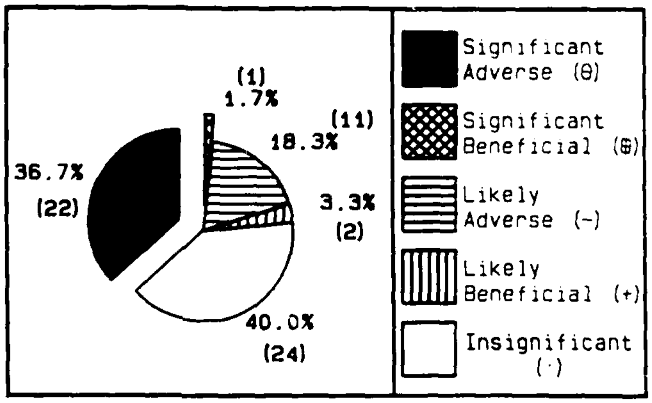
Criterion No.	Criterion	Ranking Score*	Rank
Point, Nonpoint Sources, Hazardous/Toxic Materials (Ranked Separately)			
16	SPCC Status	26	1
5	Sewage Treatment	26	2
1	Erosion/Siltation	24	3
11	Pesticides	19	4
4	Shoreline Erosion	16	5
6	Industrial Waste Treatment	12	6
7	Intermittent Sewage Treatment	10	7
15	Hazardous Waste	9	8
2	Impervious Area Runoff	8	9
14	Solid Waste Disposal	6	10
17	Abandoned Sites	6	11
10	Chemicals Operations	5	12
12	Vehicle Maintenance	5	13
3	Combined Storm Drains	4	14
8	Refueling Operations	4	15
18	UST Status	3	16
9	Munitions Operations	2	17
13	Ship Maintenance	2	18
Environmental Programs (Ranked Separately)			
21	Soil Conservation Program	58	1
22	Stormwater Management Plan	44	2
23	Wetlands Management Plan	42	3
24	Shoreline Erosion Plan	32	4
19	Forestry Management Plan	29	5
20	Wildlife/Habitat Management Plan	27	6

*See Table 5.4

Waste) reflect areas where military installations have performed especially well in controlling potential pollutant sources. Such areas include: sewage treatment plant upgrades or elimination by pumping to a municipal treatment system; upgrading of pesticides and hazardous waste storage/handling facilities and procedures; implementation of SPCC plans and containment of fuel spills; and development of land management and natural resources management plans. Many of these activities have resulted from Federal and State regulatory requirements.

5.4 SUMMARY OF DOD IMPACTS BAY-WIDE BY SCREENING CRITERIA (In order of Priority) *

5.4.1 <u>Abandoned Sites</u> (Rank 1 of 18)



DoD has its own version of EPA's Superfund program in the form of the Army and Air Force's Installation and Restoration Program (IRP); and the Navy's version is called Navy Assessment and Control of Installation Pollutants (NACIP). These reports are valuable sources of information concerning past waste disposal practices on the installations, and in many cases the abandoned sites on a given installation are ranked according to their relative environmental hazard level. The IRP and NACIP reports for each installation were carefully reviewed and it was determined that 24 (40.0%) of the 60 DoD installation complexes have an insignificant potential to impact the environment due to abandoned waste sites. Of the remaining 36 installations, 22 (36.7%) have the potential for significant adverse impacts on the environment, 11 (18.3%) are poorly defined but are likely to have adverse impacts, two (3.3%) is poorly defined but likely to have beneficial impacts, and another one (1.7%) exhibits possible significant beneficial impacts due to clean-up efforts of abandoned sites. Many of the DoD installations estimated to have a significant adverse impact potential have six or more abandoned sites identified for confirmation monitoring in the IRP or NACIP reports. The confirmation studies at some DoD installation sites have not yet been completed and results to

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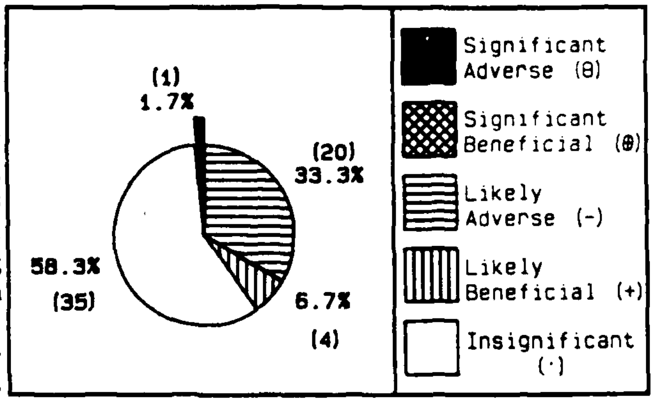
* Note: In this section, the total number of installation "complexes" is 60, and the percentages and numbers used in the text are based on a total of 60. The difference between this number and the total number (66) of installations under study is due to the grouping of two installations at Aberdeen Proving Ground, two at NAS/NATC Patuxent, and five at Sewells Point.

date are based on preliminary, and sometimes limited, data and some studies are in the early stages of development. The findings of these confirmation studies are essential in order to accurately determine the impact of abandoned waste sites on the aquatic environment.

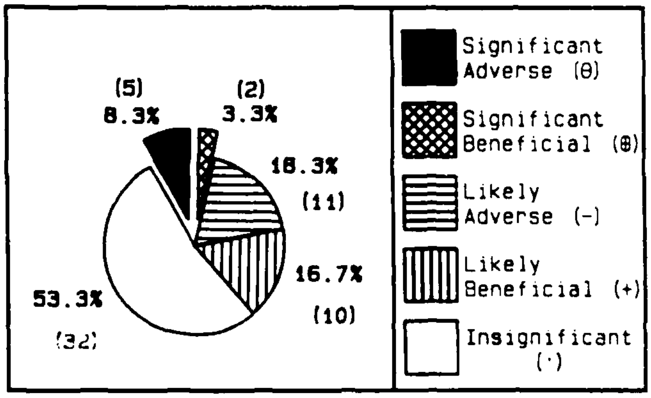
5.4.2 Impervious Area Runoff (Rank 2 of 18)

Potential problems associated with impervious area runoff include contamination of receiving waters, increase in quantity of runoff from impervious areas, and pathways for spills into the receiving water. Of the 23 installations estimated to have a potential adverse impact on the receiving water, one installation (Sewells Point Navy Complex) has a significant adverse potential impact. This installation has large areas of impervious surface and likely significant contamination of the stormwater runoff. The installations having poorly defined potential adverse impacts (20), have a high percent of impervious areas with few controls, but with unknown effects on the receiving water. The installations having a beneficial potential impact (4) generally utilize better management plans, such as use of street cleaning, and retention basins. There are 35 installations that have a low percent of impervious area and/or little or no impact on the receiving water from runoff.



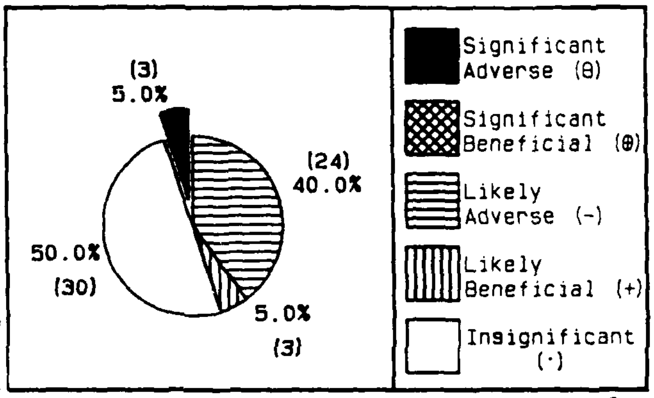
5.4.3 Erosion/Siltation (Rank 3 of 18)

There are a total of 30 installations having a potential adverse or beneficial impact on the receiving water due to erosion and siltation. Of the eight installations estimated to have a significant impact potential, six (Fort A.P. Hill, Fort Meade, HDL-Blossom Point, Letterkenny Army Depot, NAS-Oceana, and USMC-Quantico) are adverse and two (Fort Ritchie, NMCNCR) are beneficial. In spite of the use of "best management practices" for soil conservation, significant adverse potential impacts may result from areas having



greater than 100 acres being outleased for agricultural purposes, clear-cut, or disturbed, especially if these installations also have steep slopes and medium to high soil erodability. These installations have documented significant erosion and siltation problems. The installations estimated to have a significant beneficial potential impact have none of the listed factors associated with significant adverse impacts. They also have low soil erodability, effective soil conservation programs, a large percentage of undisturbed land, and reclamation and aggressive management plans for erosion control. Twenty-one (35%) of the installations have poorly defined potential impacts. Eleven of these installations have some on-site erosion, but the level of impact is unknown and erosion control effectiveness is unknown. Thirty-two of the installations have no erosion problems or do not drain directly to surface waters.

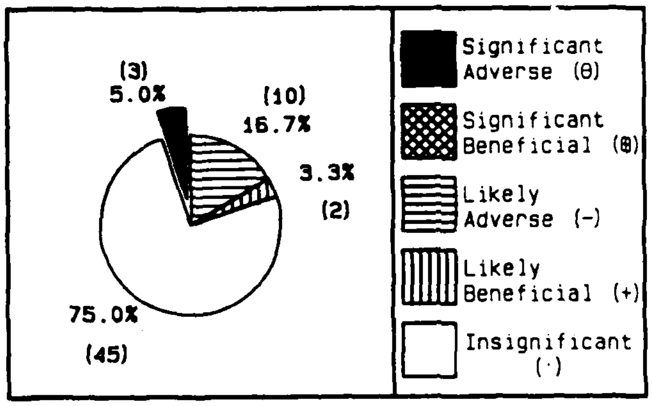
5.4.4 UST Status (Rank 4 of 18)



Many of the DoD installations store large volumes of petroleum products in underground storage tanks (USTs) and some bases have confirmed leaking underground storage tanks (LUSTs). A large number of these tanks have been in use for several decades, and it is imperative that a testing program be implemented in order to detect leaks. Under Federal law, owners of underground tanks used to store petroleum or hazardous substances had to notify designated State or local agencies of the existence of their tanks by May 8, 1986. This included owners of tanks used to store such substances and owners of tanks taken out of operation after January 1, 1974, but still in the ground. Owners who bring tanks into use after May 8, 1986, must notify within 30 days. Thirty (50%) of the 60 DoD installation complexes have an insignificant potential to impact the environment due to USTs. Of the remaining 30 installations, three (NAS Oceana, NSC-Craney Island, NSC-Yorktown) have the potential to cause significant adverse water quality impacts, 27 are poorly defined but likely to have adverse impacts, and another three (Davidsonville RDV, Defense General Supply Center, HDL-Woodbridge) are poorly defined but likely to have beneficial impacts. Some of the problems found on DoD installations include the lack of a periodic UST testing program to detect leaks in the tanks, the lack of a continuous inventory program whereby volumes in the tanks are compared with volumes withdrawn and added to determine the existence of leaks, and the continued use of known leaking USTs. At some DoD installations, leaking underground tanks have been removed and the surrounding soil has been excavated to minimize the environmental hazard. At other installations, USTs have been replaced with above ground storage tanks.

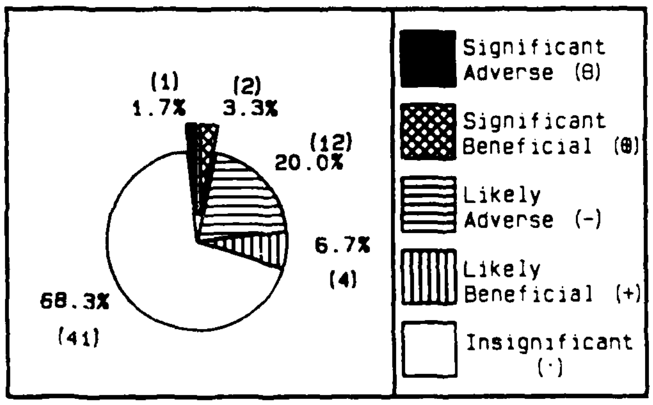
5.4.5 Combined Storm Drains (Rank 5 of 18)

There are 15 installations estimated to have potential impact from combined drains. The three installations estimated to have significant potential impacts are all adverse (NOS-Indian Head, Sewells Point Navy Complex, USMC-Quantico). These three installations have chronic violations of their NPDES permits and observed water quality problems. These installations all have significant fuel operations. There are 12 installations with poorly defined potential impacts (10 likely adverse, 2 likely beneficial) from combined storm drains. The majority of the potential impacts are adverse and indicate the lack of monitoring data, stormwater management plans, or an NPDES permit. An NPDES permit is required for all storm drains which also receive effluent from miscellaneous utility operations (heating/cooling), laboratories, floor drains, etc. If a stormwater management plan exists, the effectiveness is unknown. A total of 45 (75%) of the installations do not have any combined stormwater drains.



5.4.6 Industrial Waste Treatment (Rank 6 of 18)

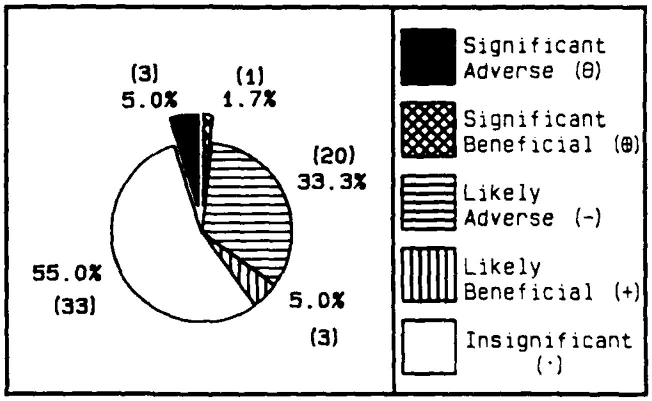
The level of industrial waste treatment at an installation varies from simple dilution into a drain to high-tech treatment and recovery systems and is dependent on the amount of waste produced. Nineteen of the installations have a potential impact on water quality due to their industrial waste treatment. One of these installations (Naval Shipyard-Norfolk) have an adverse potential impact due to either chronic NPDES violations, lack of pretreatment, discharge to leaching fields, or inadequate sludge disposal. Of the two installations having a significant beneficial potential impact (NSC-Craney Island, New Cumberland Depot), waste processing includes pretreatment and recovery systems. Also, sludges have been disposed of using permitted methods and some activities have



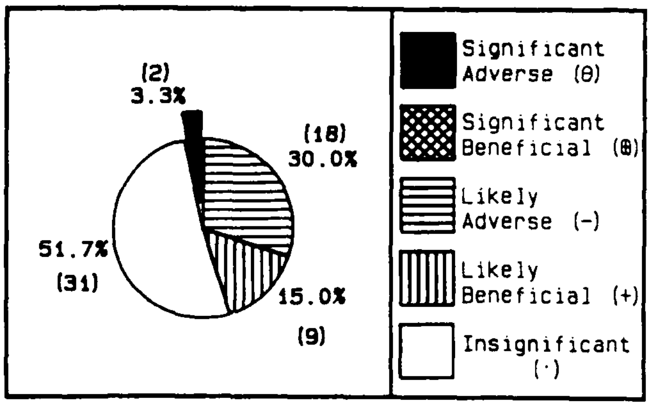
been decommissioned. The sixteen installations having an unknown potential impact from industrial waste treatment (twelve likely adverse, four likely beneficial) have either an undetermined need for pretreatment, a designated interim status for compliance of NPDES regulations, or discharge to the sanitary sewage treatment system. Industrial waste may also be generated and stored in barrels or holding tanks for later offsite disposal via a contractor. Potential impacts exist in storing waste with regard to SPCC and UST violations. Forty-one (68.3%) of the installations have an insignificant potential impact due to minor generation of industrial waste.

5.4.7 **Refueling Operations** (Rank 7 of 18)

Activities relating to refueling operations include tank farms, pier facilities, tanker trucks, and storage tanks. A total of 27 of the installations are judged to have the potential to impact the receiving water. Three (5%) of these installations (NAS-Oceana, NAS/NATC-Patuxent, Sewells Point Navy Complex) are found to have a significant adverse potential impact, whereas only one installation (USMC-Quantico) was found to have a significant beneficial potential impact. The three installations estimated to have adverse impacts have had chronic fuel spills occurring on-site and poor SPCC adherence. The remaining 23 installations have poorly defined impacts (20 likely adverse, 3 likely beneficial) with the majority of them experiencing occasional fuel spills, but the effects are not known. Some installations with major operations have upgraded or decommissioned their refueling activities. Just over half of the installations have insignificant potential impact due to minor operations (e.g., motor pool gas stations), and good spill prevention practices (i.e., good SPCC adherence).



5.4.8 <u>Hazardous Waste</u> (Rank 8 of 18)

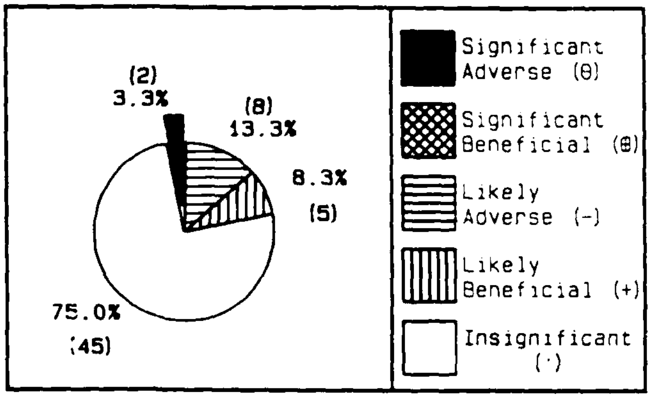


The Resource Conservation Recovery Act (RCRA), enacted by Congress in 1976, is the first comprehensive federal effort to deal with the problem of hazardous waste. RCRA is a regulatory statute designed to provide "cradle to grave" management of hazardous waste by imposing management requirements on generators and transporters of hazardous materials and upon owners and operators of treatment, storage, and disposal (TSD) facilities. RCRA requires every owner of a TSD facility to obtain both Part A and Part B permits. A TSD facility which was in existence on November 19, 1980, was authorized to continue operations without a site-specific Part B permit if it notified EPA of its hazardous waste management activities and filed a Part A application for interim status. Facilities constructed after November 1980 are required to submit both Part A and B applications and a permit must be granted before commencement of operations. In November, 1985, a law took effect whereby the interim status of all Part A permitted TSD facilities terminated unless they had submitted a Part B application for a final permit along with certification that the facility was in compliance with groundwater monitoring and financial liability requirements.

In this study, 31 (51.7%) of the DoD installations are determined to have an insignificant impact potential on water quality with regard to their hazardous waste activities. Many of these installations were so-called small generators, that is, they produced less than 100 kg of hazardous waste per month. Of the remaining 29 DoD installations, two (Fort Belvoir, Naval Shipyard-Norfolk) have the potential for significant adverse impacts, 18 are poorly defined but are likely to have the potential for adverse impacts, and nine are poorly defined but likely to have beneficial environmental impacts. Potential hazards associated with hazardous wastes on the DoD installations include TSD facilities that are not permitted and/or out of compliance with RCRA requirements, the documentation of spills involving hazardous materials, the storage of hazardous wastes in the open environment subject to exposure to the elements, the storage of hazardous wastes beyond the 180-day temporary storage time limit, and the handling of large quantities of hazardous wastes. At several installations, hazardous wastes have accumulated beyond the capacity of the storage facility because the contractor tasked with removing the wastes to an offsite disposal facility was not able to meet his removal timetable. The seven DoD installations determined to have likely beneficial impacts generally

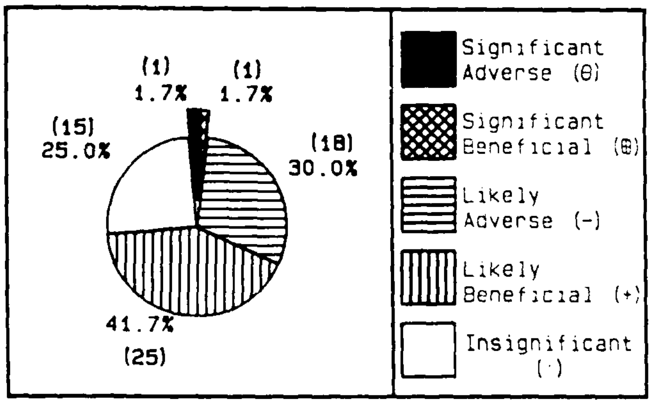
have new, conforming storage facilities and well management hazardous waste management programs.

5.4.9 <u>Intermittent Sewage Treatment</u> (Rank 9 of 18)



Intermittent sewage treatment sites include septic systems and leaching fields not requiring a NPDES permit. The systems are usually found in outlying areas that are either inaccessible for tying into a sewage treatment plant or have a low volume of waste production, or both. Of the 60 installation complexes screened, 15 are judged to have a potential impact from intermittent sewage treatment. Two (3.3%) of these installations (Brandywine DRMO, HDL-Blossom Point) have a significant adverse potential impact, both relating to high coliform counts in the receiving water. There are no installations having a significant beneficial potential impact. The 13 installations having an unknown potential impact (eight likely adverse, five likely beneficial) have systems, but there exist no documented water quality impacts. The majority of these installations have projects proposed or ongoing to upgrade to a package plant or to tie into an onsite or offsite sanitary treatment plant. Many of the existing systems have experienced poor maintenance performance and have flooded during storms. Also, if industrial waste is discharged into the system, the effectiveness of treatment is unknown. A higher percentage of installations, 75%, do not have any intermittent sewage treatment.

5.4.10 <u>SPCC Status</u> (Rank 10 of 18)



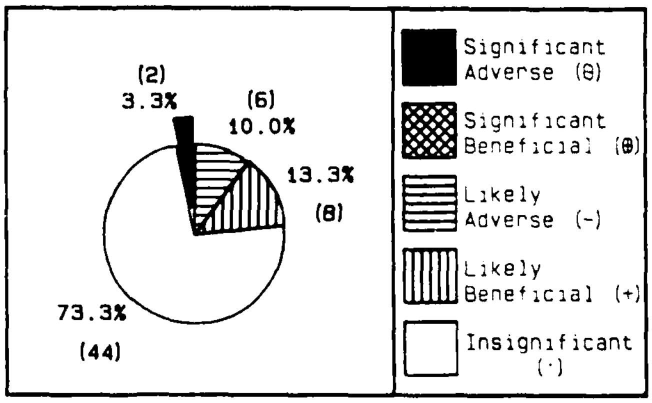
In 1972, Congress enacted the Federal Water Pollution Control Act which was significantly modified in 1977 to deal with toxic water pollutants and was renamed the Clean Water Act. In support of Section 311 of this Act, all owners and operators of large oil storage facilities (i.e., greater than 1320 gallons above ground or 42,000 gallons below ground) must comply with EPA regulations that seek to minimize the probability that an oil spill will pollute natural waters by requiring the development, implementation, and

maintenance of Spill Prevention, Control, and Countermeasure (SPCC) Plans. Thus, all DoD installations having large storage facilities are required to identify potential spill sources and develop measures to prevent accidental spill incidents. The DoD regulations governing oil and Hazardous Substances Spill Control and Contingency Plans also require cooperation with other Federal, State, regional and local government agencies. There are state, federal, and service regulations pertaining to the maintenance of these plans.

A majority of the facilities have adequate SPCC plans which will help minimize or eliminate environmental damage from oil and hazardous material spills. Results from this study indicate that 15 of the 60 DoD installation complexes in this study have an insignificant impact on the environment based on their SPCC plans. Of the remaining 45 installation complexes, one (Brandywine DRMO) has the potential for significant adverse impacts because of the SPCC status, 18 are poorly defined but are likely to have the potential for adverse impacts, 25 are poorly defined but likely to have beneficial impacts, and one (USMC-Quantico) has demonstrated that the SPCC plan has had a significant beneficial impact potential. Some problems found among the DoD installations in the Chesapeake Bay region include SPCC plans which are out of date and/or not state approved, lack of adequate on-site equipment for spill containment and clean-up, presence of equipment which is in need of repair or replacement, poor housekeeping practices, and failure of operating personnel to be aware of the pollution hazard to the aquatic environment for the substances they handle.

5.4.11 Shoreline Erosion (Rank 11 of 18)

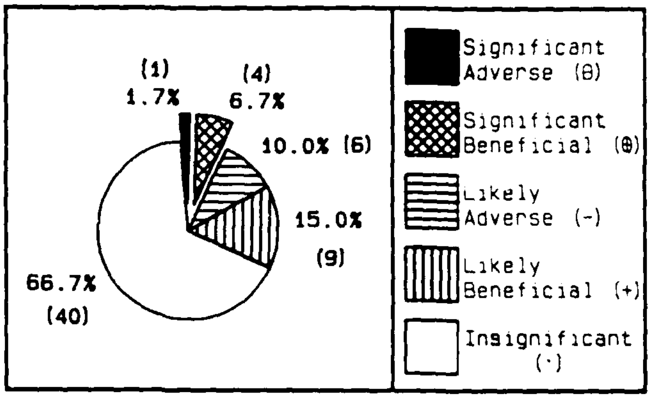
Shoreline erosion results in the loss of valuable land as well as being an impact on the receiving water. Of the 60 installation complexes screened, 16 have a potential impact on the receiving water due to shoreline erosion. There are two installations (HDL-Blossom Point, NOS-Indian Head) estimated to have a significant adverse potential impact and there are no installations having a significant beneficial potential impact.



The two installations with an adverse impact potential have little or no shoreline erosion controls resulting in the loss of low lying bluffs, prime timber stands, serviceable roads, and in one case, low lying tidal wetlands. Fourteen of the installations have poorly defined potential impacts (six likely adverse, eight likely beneficial) from shoreline erosion. Corrective actions may have been implemented, but the long term effect and cause of the erosion is unknown. Roughly

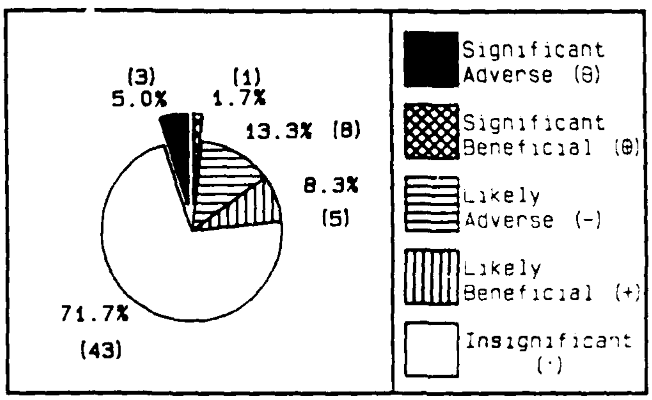
three-fourths (44) of the installations have minor shoreline erosion or are not contiguous with a shoreline.

5.4.12 Sewage Treatment (Rank 12 of 18)



Onsite sewage treatment ranges from small package plants to secondary and tertiary plants with advanced processes including nitrification (removal of nitrogen) and UV (ultraviolet) light for disinfection. Of the 60 installation complexes screened, 23 are judged to have a potential impact from on-site sanitary sewage treatment. One (1.7%) installation was found to have a significant adverse potential impact (Vint Hill Farms), whereas four (6.7%) were found to have a significant beneficial potential impact (Fort Detrick, Fort Meade, Fort Ritchie, NRL-Chesapeake Bay Detachment). Vint Hill Farms operates an STP with a known toxicity problem and has been in violation of NPDES permit regulations. The addition of industrial wastewater to the sanitary system sometimes interferes with the normal plant operation and can result in a toxic effluent condition. The four installations having significant beneficial impacts typically have advanced treatment including disinfection by UV light and sterilization, pretreatment of industrial wastewater, and compliance of all NPDES limits. The 18 installations having unknown potential impacts (ten likely adverse, eight likely beneficial), have poorly defined sewage treatment. Many of these installations are in the process of upgrading their systems or are planning to tie into a local treatment plant. Thirty-seven installations (61.7%), have already tied into an offsite treatment facility.

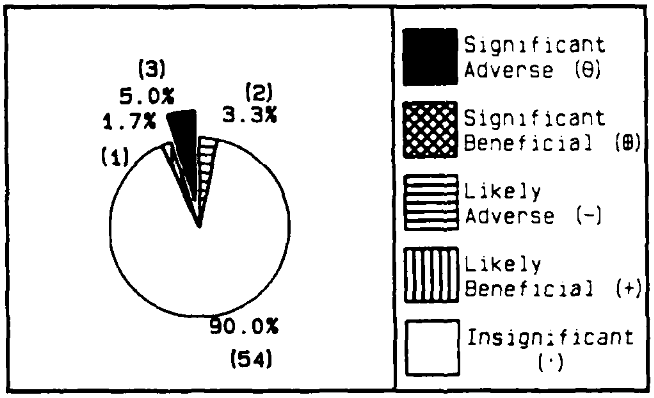
5.4.13 Solid Waste Disposal (Rank 13 of 18)



In recent years, many of the onsite sanitary landfills at DoD facilities have ceased operations. At a majority of the installations the solid waste generated onsite is disposed in offsite permitted landfills by private contractors. Of the 60 DoD installation complexes in this study, 43 (71.7%) have insignificant impact potential because solid wastes are being hauled offsite. Of the remaining 17

installations, three (Fort Eustis, Naval Shipyard-Norfolk, Vint Hill Farms Station) have the potential for significant adverse impacts, one (USMC-Quantico) has significant beneficial impacts, eight are poorly defined but have the potential to cause adverse impacts, and five are poorly defined but are likely to have beneficial impacts on the environment. Some of the water quality hazards associated with the use of onsite sanitary landfills at DoD installations include the lack of proper landfill management, inadequate containment and treatment of leachate, lack of an appropriate monitoring program to detect possible leachate migration away from the landfill, and use of a non-permitted landfill to dispose of wastes. The active landfill at Quantico represents a properly designed, well-managed operation with leachate control/treatment and a leachate monitoring system.

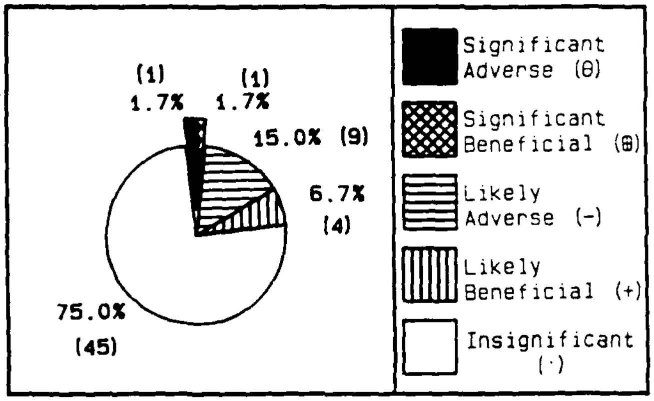
5.4.14 Ship Maintenance (Rank 14 of 18)



Only ten of the installations surveyed carry out any ship maintenance on site. The nature of ship maintenance is such that its proximity to water and the residues left by some of the attendant industry can be hazardous to water quality. Significant ship maintenance involves the use of drydocks or floating drydocks where major sand blasting and painting is done. Some of the larger shipyards do smelting of metals and some electro-plating. The processes usually involve the need for industrial treatment of the effluent. There are only three installations which perform any major ship repair and maintenance (NAB-Little Creek, Naval Shipyard-Norfolk, Sewells Point Navy Complex), and each of those presents a significant adverse potential impact on water quality. This represents 30% of the installations which have some ship maintenance. Most of the other installations which have this type of industry are only concerned with the upkeep of range boats or yard tenders, small boats which can be hauled easily and whose scrapings and paint residues can be easily contained. Within this group three installations are rated as having insignificant effects, one is rated as having potentially beneficial minor impacts, and two are rated as having potentially adverse minor impacts.

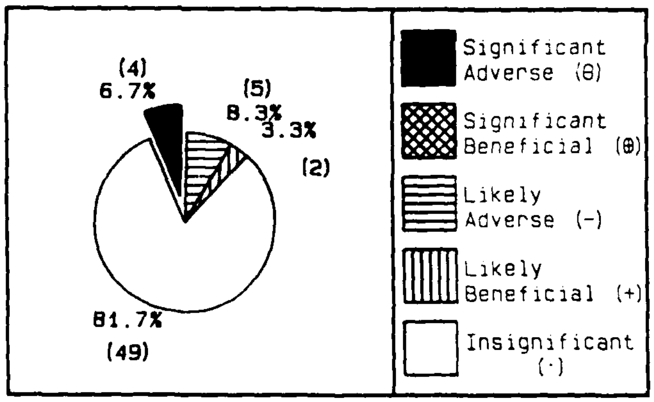
5.4.15 Vehicle Maintenance (Rank 15 of 18)

Motor pool and auto craft shops are found almost uniformly at all installations. There are 15 installations that have a potential impact on water quality from vehicle maintenance. Of the two installations having a significant potential impact, one is screened as adverse and one as beneficial. The installation estimated to have a significant adverse impact potential (NAS-Oceana) has large scale refurbishing and servicing activities that are conducted without adequate waste control and disposal procedures. The one installation estimated to have significant beneficial impacts (Vint Hill Farms Station) has recently curtailed operations that included extensive sandblasting and paint spraying. There are thirteen installations having a poorly defined adverse or beneficial potential impact. These installations have maintenance and servicing activities that have unknown effects on water quality. Seventy-five percent (75%) of installations have insignificant impacts due to minor (or zero) vehicle maintenance operations.



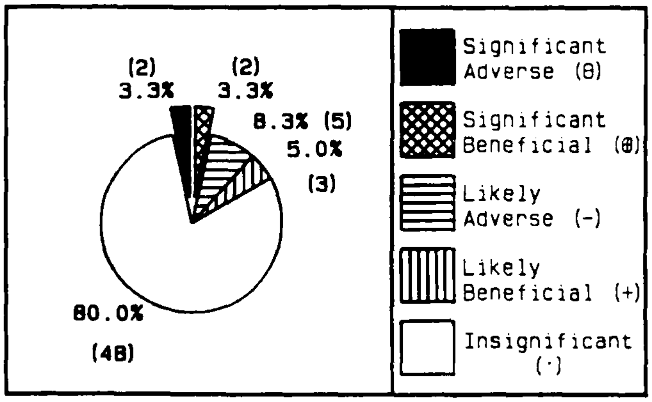
5.4.16 Munitions Operations (Rank 16 of 18)

Munitions operations include the production, use, testing, and storage of munitions in quantities greater than needed for security or small arms practice. There are 11 installations that have a potential impact due to munitions operations. Two of the facilities have poorly defined but likely beneficial impacts from munitions operations (Fort Meade, NWS-Yorktown). Four of these twelve installations (Aberdeen Proving Ground, HDL-Blossom Point, NOS-Indian Head, NSWC-Dahlgren) have significant adverse impact potential due either to widespread ordnance impacts from firing ranges to the generation of pink water discharges from inadequate waste treatment with observed water quality impacts. Five of the



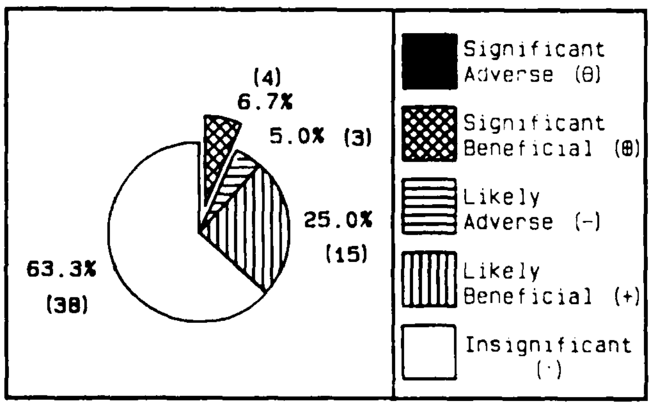
installations with an unknown potential impact have poorly defined adverse effects (Allegany Ballistics Lab, Fort A.P. Hill, Fort Belvoir, Letterkenny Army Depot, NAS/NATC-Patuxent, NSWC-White Oak). Forty-nine (81.7%) of the installations have insignificant impacts due to limited or no munitions operations.

5.4.17 **Chemical Operations** (Rank 17 of 18)



Major chemical operations that can result in potential impacts include production, testing, use, and storage of chemicals other than those used in general laboratory and maintenance activities. Twelve (20%) of the installation complexes are found to have an impact potential. Installations having a significant potential impact are equally divided between adverse and beneficial with two each. The two installations estimated to have significant adverse impacts (Aberdeen Proving Ground, Naval Shipyard-Norfolk) have exhibited extensive non-compliance for storage areas and chemicals entering into the receiving water. Both significant beneficial installations (Fort Detrick, New Cumberland Army Depot) have decommissioned past operations that were formerly major contributors of chemicals. The 8 installations having an unknown potential impact have poorly defined effects relating to storage facilities, chemical use and testing, management plans, and production. The 48 installations (80%) having an insignificant potential impact generally have minor chemical operations relating to laboratory and maintenance and also have good management plans (e.g., SPCC).

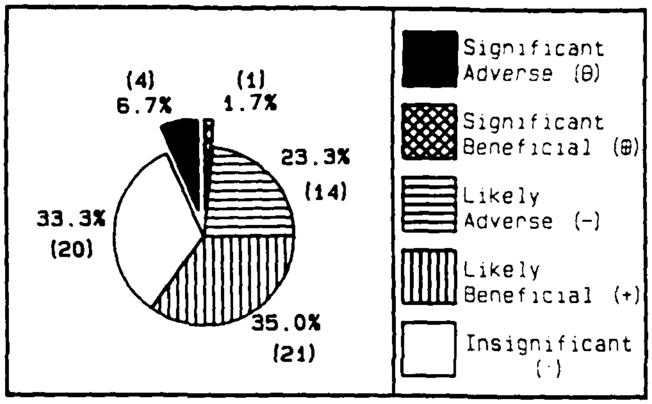
5.4.18 **Pesticides** (Rank 18 of 18)



The pesticide programs having a potential impact on the receiving water number 22 out of the 60 installation complexes screened. Of the four installations having a significant potential impact (Fort Lee, Fort Meade, Fort Ritchie, Langley AFB), all are beneficial. All of these installations have substantially upgraded their pesticide operations. Two of the installations have incorporated biological pest control into

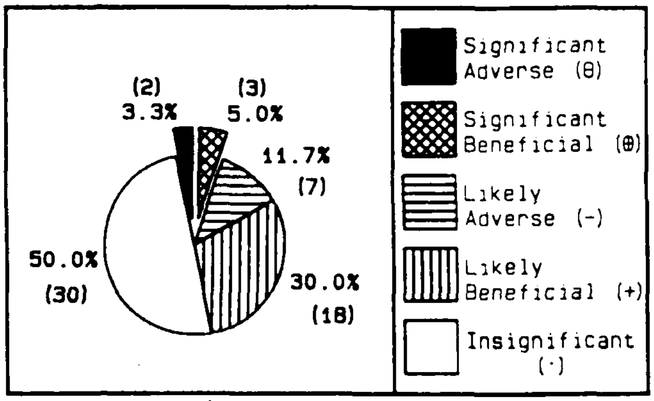
their programs. The absence of any installations having a significant adverse potential impact indicates the nationwide emphasis on pesticides as an environmental concern. The 18 installations having poorly defined adverse or beneficial potential impacts are generally characterized as having pesticide programs with well trained staff and storage facilities in compliance, but the effectiveness of these programs are unknown. A few of the installations have programs that are implementing improved management practices and/or are upgrading storage and handling facilities. The 38 (63.3%) installations having insignificant impact potential either have minor pesticide use and storage or their program is administered by an outside agency certified in pest control.

5.4.19 **Stormwater Management Plan** (Rank 1 of 6 for Environmental Programs)



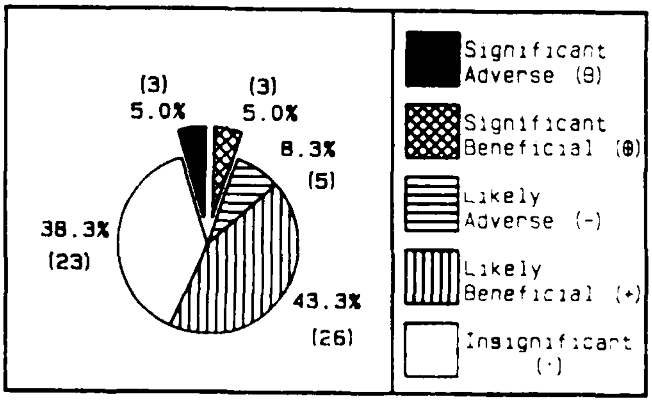
A large number of installations, especially those with aircraft runways, have a high amount of imperviousness which emphasizes the volume and rate of stormwater runoff emanating from the installation. This often overtaxes the local drainage channels and causes severe erosion of stream banks. In addition, stormwater runoff collects and transports sediment, pesticides, herbicides, and petroleum spill products that may be found on parking lot pavements and refueling areas. Twenty of the 60 DoD installation complexes were deemed to have insignificant impacts due to stormwater management practices. Of the remaining 40 installations, four (Fort Belvoir, NAS-Oceana, NSC-Craney Island, NSC-Yorktown) have the potential for significant adverse impacts, one (Fort Ritchie) shows a significant beneficial impact potential, 14 are poorly defined but likely have adverse impact potential, and 21 are poorly defined but likely have beneficial impacts. The installations in the "significant adverse impact" category experience problems such as stream bank erosion due to high quantities of runoff from runways, failure or lack of oil/water separators during storm and high tide events, and discharge of industrial wastewater into the storm sewer. Some installations have extensive stormwater management systems which attenuate the peak flows and effectively remove oil from the waters before releasing it from the installation. Others have ongoing sampling programs which monitor storm discharges at various points periodically for a variety of constituents including BOD, dissolved oxygen, heavy metals, and oil and grease content.

5.4.20 Wetlands Management Plan (Rank 2 of 6 for Environmental Programs)



The implementation of a wetlands management plan for an installation can have a significant beneficial impact on water quality in the vicinity if it is an aggressive plan to provide expansion of existing wetlands and to vigorously protect them. Some installations espouse this kind of wetlands improvement program and thus rate highly in the "significant beneficial impact" group. There are three such installations (Fort Meade, HDL-Woodbridge, New Cumberland Army Depot) within the 30 which have significant areas of wetlands on-site and which rate as significant benefits to water quality. The majority of installations which have a wetlands management policy have only a limited non-use philosophy which does nothing aggressive to restore or expand existing wetlands. These installations are generally rated in the "poorly defined but likely beneficial" screening group because this passive policy actually preserves the production and contribution of the wetlands to the Bay. Eighteen (30%) of the installations rated in this screening group, and another seven (11.7%) have been placed in the "poorly defined but likely adverse" group because some activities on the installation appear to be detrimental to the wetlands (i.e., industrial discharges, stormwater runoff, leachate migration). Two installations (HDL-Blossom Point, NSC-Yorktown) have been rated as having definite detrimental impact on wetlands in the area of the installation, due to ordnance impacts (Blossom Point) and contamination of wetland areas (NSC-Yorktown).

5.4.21 Soil Conservation Program (Rank 3 of 6 for Environmental Programs)

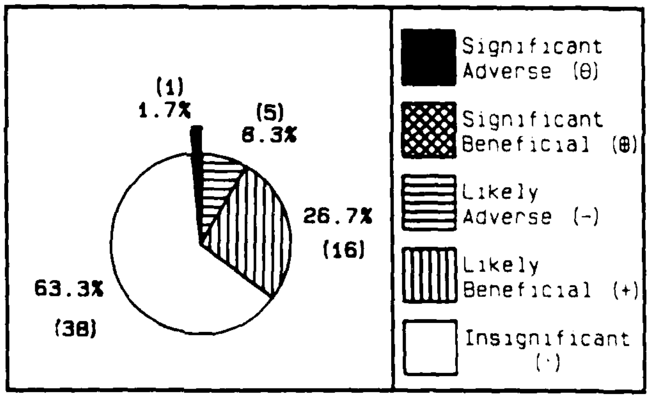


A large number of DoD installations address soil conservation in their land management plans. The implementation of soil erosion control practices is especially important in the vicinity of construction projects that disturb large areas of land. This disturbed soil is carried to surface waters via overland runoff during rainfall events and can cause siltation and turbidity of local streams and ponds

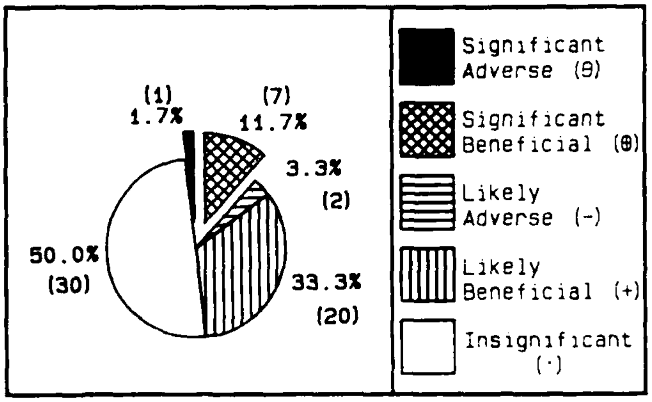
which is detrimental to aquatic life. Of the 60 installation complexes screened, 23 were judged to have an insignificant impact on the environment due to their soil conservation plans. Many of these installations are older bases which have plush, well-maintained landscaped grounds with little or no disturbed areas. Of the remaining 37 DoD installations, three (Allegany Ballistics Lab, Fort A.P. Hill, HDL-Blossom Point) have the potential for significant adverse impacts, three (Fort Ritchie, HDL-Woodbridge, Naval Academy Farm) exhibit the potential for significant beneficial impacts, five (Andrews AFB, Letterkenny Army Depot, NAS-Oceana, USMC-Quantico) are poorly defined but are likely to have adverse impacts, and 26 are poorly defined but likely to have beneficial impacts due to current soil conservation programs. The installations rated in the "significant adverse impact" category have confirmed areas of significant erosion which could be brought under control with an effective soil conservation plan. The three installations rated in the "significant beneficial impact" category (Naval Academy Farm, Fort Richie, HDL-Woodbridge) all have effective soil conservation programs and use Best Management Practices to control erosion.

5.4.22 **Shoreline Erosion Control Plan (Rank 4 of 6 for Environmental Programs)**

There are 22 installations which appear to have the need for some form of shoreline erosion control plan. Of these, none were seen as providing an active and effective plan, mainly due to the fact that in most cases erosion control structures have been in place for a long period of time and it is impossible to determine, without detailed analysis, whether the plan is effective. The same is true for most cases where an installation has some shoreline erosion problems but has not implemented an active shoreline protection scheme. It is difficult to assess what the impacts are without more detailed analysis. Consequently, nearly all of the 22 installations fall into either the poorly defined but likely beneficial group (16), or into the poorly defined but possibly detrimental group (5). Only one installation (HDL-Blossom Point) is deemed to have a significant shoreline erosion problem that is clearly detrimental to water quality.

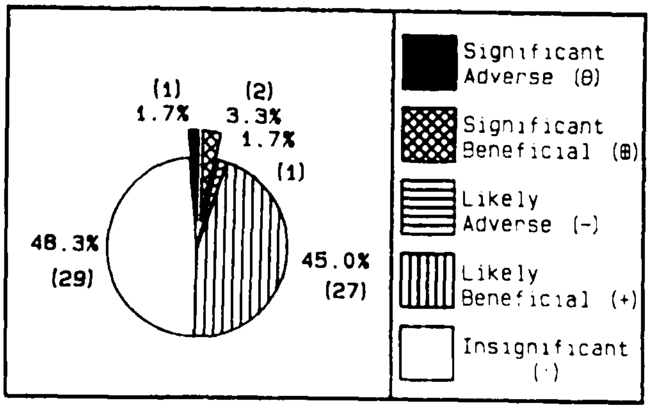


5.4.23 **Wildlife/Habitat Management Plan** (Rank 5 of 6 for Environmental Programs)



Wildlife/habitat management plans are considered to have an insignificant impact on water quality at 30 of the 60 DoD installation complexes primarily because many of these installations are set in urban areas. Of the remaining 30 installation complexes, one (HDL-Blossom Point) has the potential for significant adverse impacts due to its on-site activities, seven (Aberdeen Proving Ground, Fort A.P. Hill, Fort Meade, HDL Woodbridge, NAS/NATC-Patuxent, Naval Observatory, Naval Station-Annapolis) have shown potential for significant beneficial impacts, two (Naval Communications Unit, NSC-Craney Island) are poorly defined but likely to have adverse impacts, and 20 are poorly defined but likely to have beneficial impacts. Many of the installations falling into the "poorly defined, likely beneficial" category have passive wildlife management programs, such as declaring a part of the installation to be a bird sanctuary. On the other hand, the installations in the "significant beneficial impact" category have progressive programs which actively protect or increase waterfowl nesting areas, guard bald eagle nesting sites, build nesting towers, monitor water quality and fish in local lakes and streams, and promote general enhancement of wildlife habitats. The one installation in the "significant adverse impact" category (HDL-Blossom Point) has a wildlife management plan, however, wildlife and habitat areas are being destroyed as a result of the installation's activities. This is of special concern because the Bald Eagle, a federal endangered species, is known to nest on the installation and the shortnosed sturgeon, another federal endangered species, also occurs in the waters of the Potomac River near the installation.

5.4.24 **Forestry Management Plan** (Rank 6 of 6 for Environmental Programs)

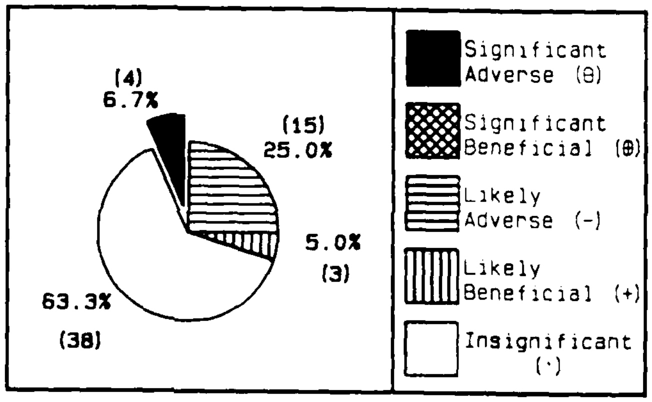


A forestry management plan at an installation can have a major beneficial impact on water quality if it preserves large areas of forest in its natural state or if it mandates strict controls on logging operations with regard to soil erosion and replanting measures. A total of 29 of the DoD installations are rated as

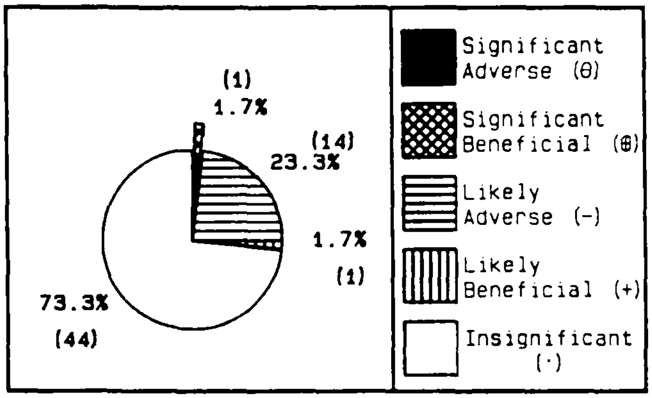
having insignificant impact potential based on the forestry management criterion. This is mainly due to the fact that many of the installation complexes have little or no areas of forested lands and, hence, forestry management is not applicable. Of the remaining 31 installation complexes, two (Fort A.P. Hill, USMC-Quantico) have the potential for significant adverse impacts, one (HDL-Blossom Point) is poorly defined but likely to have an adverse impact potential, 27 are poorly defined but are likely to have a beneficial impact potential, and one (Fort Meade) exhibits the potential for major beneficial environmental impacts from forestry management. The two installations rated as potential significant adverse candidates allow clear cutting and show evidence of erosion and siltation problems linked to that practice. Fort Meade provides an important outdoor recreational area which represents the only accessible area of its kind in the Baltimore-Washington corridor. Some DoD installations have active reforestation and reseeding programs to minimize impacts of logging operations on water quality in the local vicinity.

5.4.25 Shellfish Areas (Not Ranked for Vicinity Screening Criteria)

An installation's impact on shellfish beds is difficult to assess due to the decline in shellfish production in the Bay over the last 100 years, or so. In general, if an installation is considered to have a significant impact potential due to the existence of potential pollutant discharges and is located within two tidal excursions of an important commercial shellfishing area, it has been rated as having a significant impact potential for this criterion. Four of the installations (Fort Eustis, HDL-Blossom Point, NAB-Little Creek, NSC-Craney Island) fall into the significant adverse impact potential screening group. Fifteen installations fall into the "poorly defined but likely adverse" impact group. Three installations are deemed to have a "poorly defined but likely beneficial" impact, and none have significant beneficial impacts on shellfish areas.

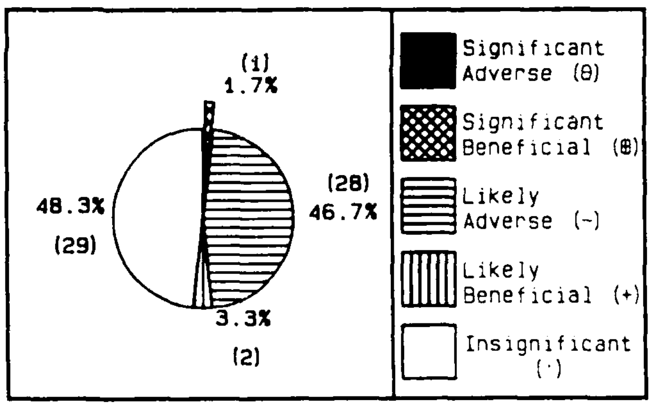


5.4.26 <u>Submerged Aquatic Vegetation</u> (Not Ranked for Vicinity Screening Criteria)



The distribution of SAV in the Chesapeake Bay is limited and areas where SAV is likely to be affected by the presence of an installation are few. The last 15 years has seen a significant decline in the distribution of SAV in the Bay. Historical perspectives of this decline do not shed much light on the causes. Only 16 of the installations in the study are thought to be in any way affecting the presence of SAV. Of the 16 installations that are near SAV beds, one (Aberdeen Proving Grounds) is having a significant beneficial impact on those beds due to SAV replanting, one (Bolling AFB) is having "poorly defined but likely beneficial" impacts, and the rest (14) are having "poorly defined but likely adverse" impacts.

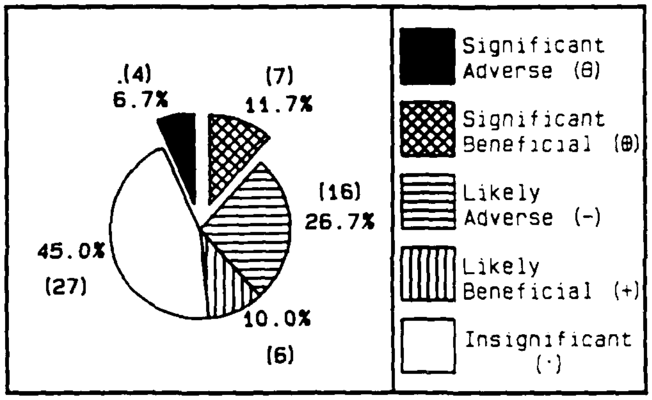
5.4.27 <u>Fish Spawning Areas</u> (Not Ranked for Vicinity Screening Criteria)



The Chesapeake Bay and its tributaries are important nursery and spawning areas for numerous species of anadromous and freshwater fish and also is a nursery ground for a number of marine spawning species. In assessing the impact on various nursery spawning areas only one installation (HDL-Woodbridge) was found to have a significant beneficial impact on spawning areas and two (Davidsonville RDV, NAVRADSTA-Sugar Grove) are found to have "poorly defined but likely beneficial" impacts due to the protection and enhancement of the nearby fish spawning areas. A large number of the installations (29 or 48.3%) are found to have "poorly defined but likely adverse" impacts.

5.4.28 <u>Wetlands Areas</u> (Not Ranked for Vicinity Screening Criteria)

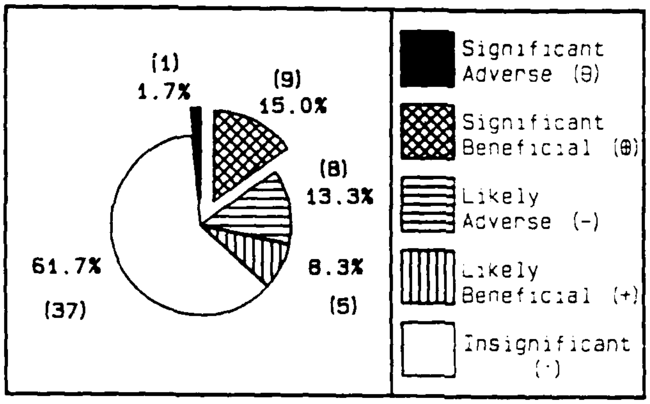
This criterion provides an interesting contrast to one of the on-site criteria, the Wetlands Management Plan of Section 5.4.20. The change in perspective between on-site and vicinity now becomes apparent. When looking at the impact to wetlands from the installation management plan perspective it appears that the installations can have a potentially beneficial impact on wetlands. However, the potential of the installations



to negatively impact wetlands, from the perspective of proximity and health of the marshes, is apparent in the vicinity criterion. Of the 32 installations with wetlands impacts, seven are believed to provide significant beneficial impacts to the wetlands in their proximity. Four of the installations, however, are said to present significant adverse impact potential to local wetlands (HDL-Blossom Point, NAB-Little Creek, Naval Shipyard-Norfolk, NSC-Yorktown). Of the remaining 22 installations, six are rated as having possibly beneficial impacts while 16 are rated as having possibly adverse impacts on local wetlands.

5.4.29 <u>Waterfowl Nesting</u> (Not Ranked for Vicinity Screening Criteria)

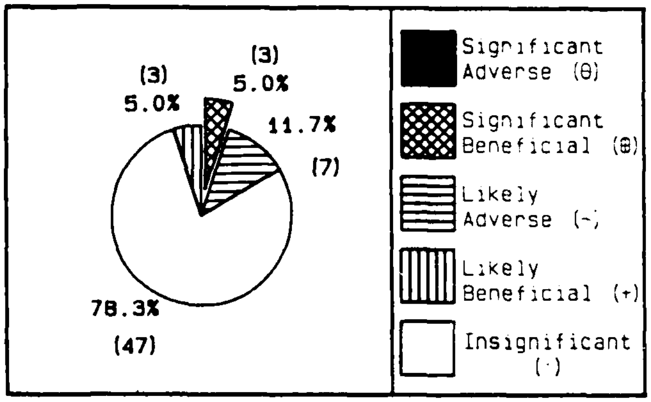
Only 23 installations have waterfowl impacts, however this criterion has the most positive rating overall. This is due to the number of nesting and wintering enhancement programs that exist in the Chesapeake Bay area. Most of these programs provide nest installations and cover for ospreys and ducks. The waterfowl program, however, has the least effect on water quality of any criteria. Nine installations are rated as having significant



beneficial impacts on water quality while only one (HDL-Blossom Point) is rated as having significant adverse impacts. Five are rated as having "poorly defined but likely beneficial" impacts, and eight are rated as having "poorly defined but likely adverse" impacts.

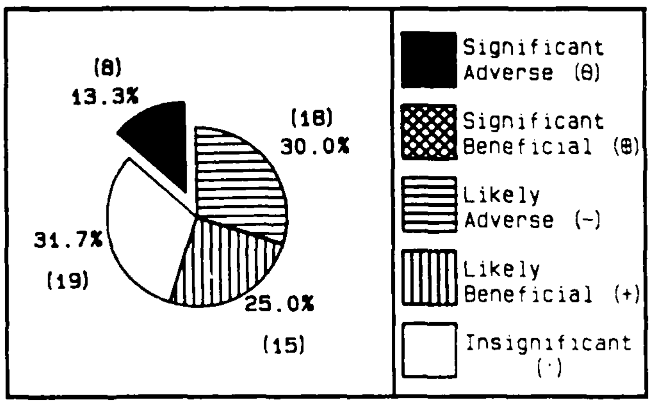
5.4.30 **Endangered Species** (Not Ranked for Vicinity Screening Criteria)

Few installations have records of water quality related endangered species either living on-site or using the installation as a spawning ground. Only 13 installations have records of visitations or presence of endangered species. Three of these installations provide significant beneficial impacts to endangered species while three are deemed to have "poorly defined but likely beneficial" impacts. The other seven installations are rated as having "poorly defined but likely adverse" impacts.



5.4.31 Relative Local Impact (Not Ranked)

The relative impact level of an installation on local water quality is based on the installation's contribution of pollutants to the receiving water relative to other contributions, as well as the degree of existing pollution of the receiving water. The installations having a significant potential impact (none beneficial and eight adverse) have well documented findings concerning the level of pollutant contributions. The The eight installations having a significant adverse impact potential (Aberdeen Proving Ground, HDL-Blossom Point, NAS-Oceana, NAS/NATC-Patuxent, NOS-Indian Head, Naval Shipyard-Norfolk, NSC-Yorktown, NWS-Yorktown) are estimated to contribute significantly to the pollution load of the local receiving waters. Over half of the installations (33) have poorly defined relative local impact. The contribution of these installations to the overall pollutant loading of the receiving water is not well known. Eighteen (30%) of the installations have an insignificant potential relative impact on local water quality. These installations are judged to have an insignificant potential impact because they had low levels of pollutant loading or they were not on or near a tributary of Chesapeake Bay.



5.5 SUMMARY OF DOD IMPACTS BY REGION AND BAY-WIDE

5.5.1 Introduction

An important general finding of this study is that, with the exception of a few installations, the region of influence of military activities appears to be limited to the immediate vicinity of the installations. The exceptions (Aberdeen Proving Ground, NSWC Dahlgren, HDL-Blossom Point) are unique because of the impacts of ordnance shelling over large areas of wetlands and/or open water areas. This study has, because of the nature of most installation activities, focussed on the immediate vicinity, or near-field, effects of the installations. The relative regional, or far-field, effects of the installations or groups of installations must also be viewed in context of: (1) the large scale Bay-wide changes in environmental quality noted in the past decade; and (2) the critical ecological functions historically attributed to the particular regions. Some of these far-field trends on Chesapeake Bay are presented in Chapter 4.0 of this report (Sec. 4.1), as are brief descriptions of the 13 regions into which the DoD installations were grouped.

Briefly, the major EPA-CBP study of the late 1970's examined many facets, but concentrated on three aspects.

1. The distribution of toxic materials, i.e., inorganic (metals) and man-made organic compounds throughout the Bay. Areas of significantly elevated concentrations of these materials and compounds were found at the head of the Bay, Baltimore harbor, and the Hampton Roads-Elizabeth River system.

2. The Bay-wide loss of submerged aquatic vegetation (SAV) was characterized. This decline was found to have started in the early 1970's at the head of the Bay, and has progressed down the Bay with a near depletion of SAV in most areas. Some areas of the lower Eastern Shore of Virginia were apparently little affected. Adjacent emergent grasses (wetlands) do not seem to have been generally affected except by local development pressures.

3. Large scale trends of water quality were determined, especially as related to cultural eutrophication. Increases in concentrations of phosphorous and nitrogen were established, and decreases in light penetration and dissolved oxygen in some areas were found.

During and since the EPA-CBP study, there has been a continuing general decline of certain estuarine dependent species of finfish and shellfish of commercial and recreational significance. The reproductive potential of these species, especially in fresh or oligohaline waters, seems to be impaired. Marine species utilizing the estuary as nursery grounds do not seem to be affected, and may be increasing in numbers in the Bay to fill the ecological niche.

Generally the findings of the EPA-CBP study indicated that the Bay Region has sustained substantial population growth over the past several decades, with attendant land use changes and increased waste disposal consequences, and that agricultural practices have greatly increased nonpoint source nutrient and sediment loadings throughout the estuary. It is worth noting that there were probably little or no significant changes in the number or types of DoD installations and/or activities on the Bay during this period.

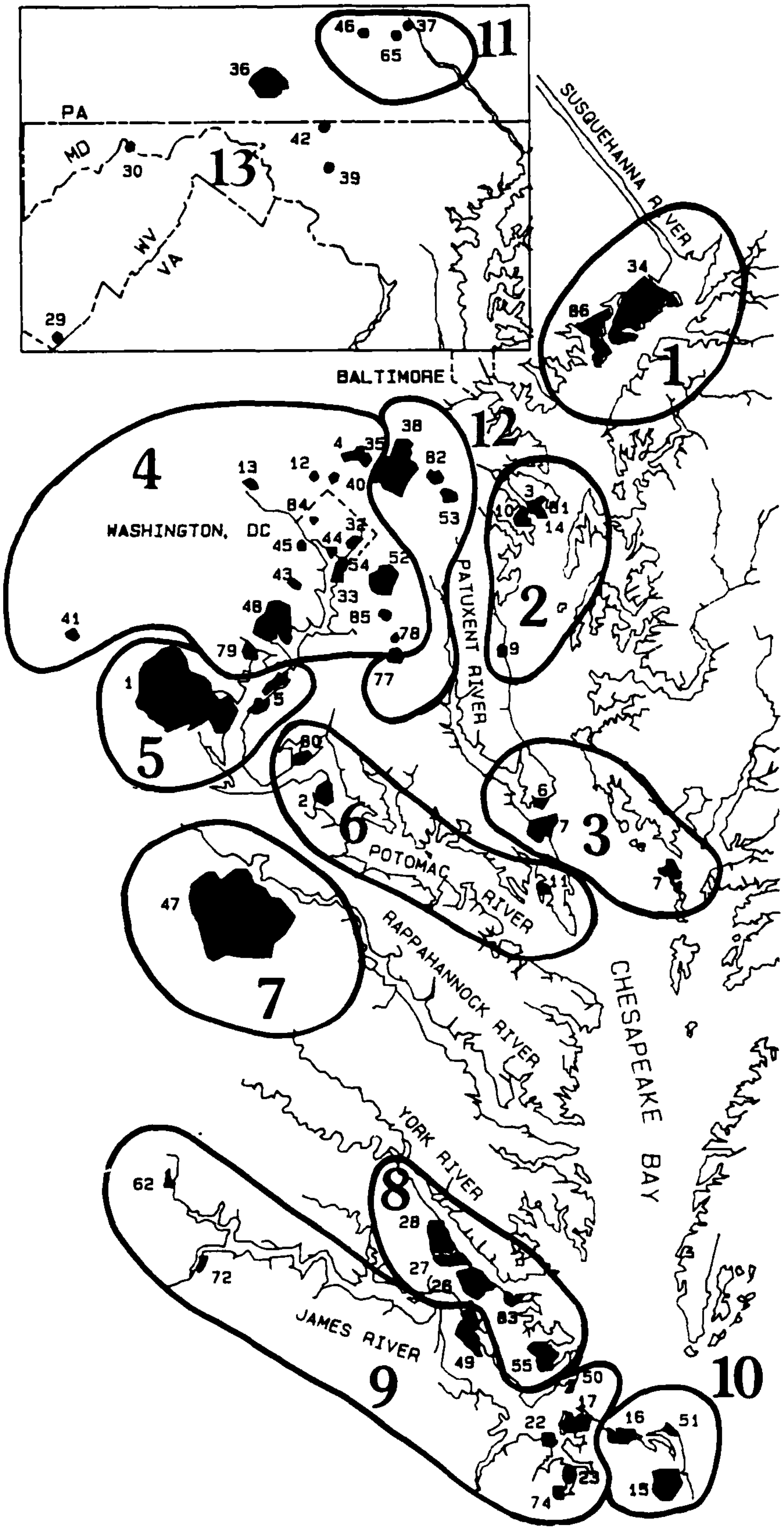
Alleviation of these problems will involve large scale changes in social, economic, and technological practices on adjacent Bay land uses, some of which are currently being implemented at the State level. The various management schemes identified to control and reduce pollutant sources to the Bay from point and nonpoint sources were summarized in Chapter 3.0 of this report (Sec. 3.1).

5.5.2 Summary by Region

The EPA-CBP compilation of environmental information developed the practical concept that the Chesapeake Bay is comprised of relatively distinct segments, definable by their hydrographic and biological characteristics. Some areas of the Chesapeake estuary are intrinsically more fragile and vulnerable to environmental stress than others. The tidal fresh waters at the head of the Bay, in the vicinity of Aberdeen Proving Ground and ancillary facilities, are ecologically more critical and vulnerable than, for example, the region at the mouth of the Patuxent River with its Naval installations. This implies that different management strategies will be, more or less, pertinent in the various regions. Figure 5.2 presents the overall DoD installation summary of impact potential by Study Group and by regional location. This figure is intended as a visual aid to identify the regional locations of installations representing a relatively significant impact potential on local water quality and biological resources of the Bay. It can be seen in Figure 5.2 that installations in Study Groups 1 (significant impact potential) and 2 (poorly defined but likely significant impact potential) are distributed throughout the Bay in 11 of the 13 regions used in this study. Discussion of DoD impacts by region is briefly presented in the following sections.

5.5.2.1 **Region 1: Upper Chesapeake Bay**. This region of tidal fresh waters near Aberdeen Proving Ground is probably the most vulnerable of the Bay segments and is an area considered critical for:

1. Spawning of estuarine dependent fishes, such as striped bass and white perch;
2. Spawning of anadromous finfish such as shad and some clupeids;
3. Nesting and rearing areas for some estuarine dependent raptors, such as eagle and osprey;



STUDY GROUP 1

- 34,86 Aberdeen Proving Ground
- 80 Harry Diamond Lab-Blossom Point
- 15 Naval Air Station - Oceana
- 7,8 NAS/NATC - Patuxent River
- 5 Naval Ordnance Sta.-Indian Head
- 23 Naval Shipyard - Norfolk
- 83 Naval Supply Center - Yorktown
- 26 Naval Weapons Station-Yorktown
- 17-21 Sewells Point Naval Complex

STUDY GROUP 2

- 30 Allegany Ballistics Lab
- 52 Andrews Air Force Base
- 62 Defense General Supply Center
- 48 Fort Belvoir
- 49 Fort Eustis
- 38 Fort Meade
- 55 Langley Air Force Base
- 36 Letterkenny Army Depot
- 16 Naval Amph. Base - Little Creek
- 27 Naval Sup. Cen.-Cheatham Annex
- 22 Naval Sup. Cen. - Craney Island
- 2 NSWC - Dahlgren
- 4 NSWC - White Oak
- 65 Navy Ships Parts Control Center
- 1 USMC/MCDEC - Quantico
- 41 Vint Hill Farms Station

STUDY GROUP 3

- 54 Bolling Air Force Base
- 78 Brandywine DRMO
- 77 Brandywine Rec. & Housing Annex
- 43 Cameron Station
- 28 Camp Peary
- 14 David Taylor NSRDC - Annapolis
- 47 Fort A.P. Hill
- 39 Fort Detrick
- 51 Fort Story
- 35 Harry Diamond Lab - Adelphi
- 6 Naval Air Sta. - Solomons Annex
- 11 Naval Elect. Sys. Engr. Act.
- 12 Naval Medical Command - NCR
- 29 Naval Radio Station-Sugar Grove
- 33 Naval Research Lab - Wash., DC
- 9 Naval Research Lab - CBD
- 3 Naval Station - Annapolis
- 37 New Cumberland Army Depot
- 74 St. Juliens Creek Annex
- 40 Walter Reed Army Medical Center
- 32 Washington Navy Yard

STUDY GROUP 4

- 46 Carlisle Barracks
- 13 David Taylor NSRDC - Carderock
- 53 Davidsonville RDV
- 72 Fort Lee
- 44 Fort McNair
- 50 Fort Monroe
- 45 Fort Myer
- 42 Fort Ritchie
- 79 Harry Diamond Lab - Woodbridge
- 85 Naval Communications Unit
- 84 Naval Observatory - Wash., DC
- 81 Naval Radio Transmit. Facility
- 10 U.S. Naval Academy
- 82 U.S. Naval Academy Dairy Farm

Figure 5.2 Locations of DoD Installations within the 13 Chesapeake Bay Regions.

4. Major overwintering grounds for waterfowl, especially canvasback and redhead ducks; and
5. Significant wetlands, now considered an integral part of the estuarine ecosystem.

This region has large scale environmental stresses on it from:

1. Major silt inputs, primarily from the Susquehanna River;
2. Abnormally elevated nutrient concentrations, notably nitrogen and phosphorous, from the Susquehanna River;
3. Abnormally elevated metal and anthropogenic organic compounds, probably from the Susquehanna watershed;
4. The nearly complete loss of SAV in the entire region, but especially in the Susquehanna Flats; and
5. Acid rain. (These fresh water regions are more susceptible to environmental damage from acid rain than the more saline reaches with greater buffering capacity. Some recent studies indicate large scale changes in pH in the region attributed to acid rain.)

The environmental implications for the DoD facilities is that land management and general environmental controls must be more carefully applied in this region than in most others. Controls of point source and nonpoint sources of nutrients, leading to abnormally high concentrations of phytoplankton with subsequent loss of light penetration, are especially pertinent to this region.

Aberdeen Proving Ground is the only DoD installation operating in the Upper Chesapeake Bay region. APG (ranked in Study Group 1) is an exceedingly complex installation, and it is difficult to determine with confidence the level of environmental impact on surface waters based only on existing information. Overall, however, APG does not appear to have a significant impact on the Upper Chesapeake Bay region. Rather, conditions in this region are dominated by the pollutant and sediment loads entering from the Susquehanna River. APG's influence, other than the contamination of open water areas by ordnance shells, appears to be confined to the creeks and waters directly on or adjacent to it. The primary area of concern at APG involves the existence of several past sources of toxic contaminants from the munitions and chemical research and testing activities that once discharged into the local tidal creeks and wetlands throughout the installation. Available data collection efforts designed specifically to investigate the presence of toxics are very limited but, where available, have indicated the presence of toxics above chronic toxicity threshold levels for the protection of aquatic life. Key recommended actions for this installation therefore include expansion of monitoring activities specifically designed to detect the presence of chemical agents representative of the activities that have occurred at APG.

5.5.2.2 Region 2: Mouth of Severn River (Upper Central Bay). The Severn River is steadily losing its oystering ground resources, due to past fishing pressures, general lack of reproductive success, and increasing closures due to urban and suburban development in the vicinity. This area has lost nearly all of its SAV. Water quality degradation, especially bacterial contamination and low dissolved oxygen in some bottom waters, has become more widespread. None of these changes can be directly attributed to the five DoD installations (Figure 5.2) but reflect the general trends noted in the Bay and the increasing local urbanization.

None of the five DoD installations in this region were found to represent a likely significant potential for adverse water quality impacts. There are no major industrial activities or point sources at these facilities. Existing areas of concern are relatively minor in nature and include release of pollutants in storm drains (DTNSRDC, U.S. Naval Academy), shoreline erosion at the Naval Station and NRL-CBD, and management of hazardous materials (Naval Station, U.S. Naval Academy). No information exists, however, to indicate that these installations have created any significant adverse impacts on water quality. Compared to the surrounding point and nonpoint sources, these installations likely contribute an insignificant loading of pollutants to the Upper Central Bay region. Beneficial activities on these installations have included upgrading sewage treatment systems (Naval Station, NRL-CBD), and development of land management and natural resources programs (all installations).

5.5.2.3 Region 3: Mouth of Patuxent River (Central Bay). The reaches of the lower Patuxent estuary and adjacent Bay waters have experienced the decline of SAV and estuarine dependent fishes noted elsewhere in the Bay. Oyster and soft-shell clam fisheries have declined, partially due to fishery pressure and partially due to their unexplained lack of reproductive success noted in recent years. Generally, water quality is considered good. The three Naval installations (Figure 5.2) have apparently no significant far-field effects in the region.

Of the three installations operating in this region, NAS and NATC Patuxent were ranked in Study Group 1. Areas of local concern at NAS/NATC include lack of a stormwater management plan and monitoring program for the extensive storm drainage system, lack of secondary containment facilities around POL storage areas, detection of contaminants (fuels) leaking into local onsite surface waters from fuel storage areas, and the continuing evaluation of several NACIP confirmation study results for several past spill sites and inactive waste disposal sites which have the potential to leach contaminants into ground and surface waters. All of the above concerns relate primarily to activities that are difficult to control or regulate. In general, NAS/NATC's impacts on the regional water quality are believed to be minor. The surrounding agricultural activities and upstream pollutant loadings are primarily responsible for the eutrophic conditions observed

in this area. NAS/NATC's impacts are more likely confined to receiving waters located adjacent to the installation. There is a general lack of appropriate data local to the installation, however, to quantify NAS/NATC's impact.

5.5.2.4 **Region 4: Tidal Fresh Potomac River**. Urban Washington, D.C. has seriously degraded the tidal Potomac for approximately 60 miles downstream for decades. Extensive efforts, especially in sewerage and sewage treatment, have somewhat alleviated the conditions in the past decade. This reach of the estuary and the small creeks feeding it in the urban area generally will continue to be ecologically substandard due to the urban surroundings. Water quality in this reach of the tidal fresh waters is impaired by low dissolved oxygen, turbidity, nutrients, and elevated bacterial concentrations. The eighteen DoD facilities (Figure 5.2) are generally served by the regional facilities and programs, and can be considered as an integral part of the urban setting, in context of far-field effects.

Four of the 18 installations (NSWC-White Oak, Vint Hill Farms, Fort Belvoir, and Andrews AFB) were estimated to represent a poorly defined but likely significant adverse impact potential for local water quality and biological resources. Areas of concern for these four installations include stormwater runoff and poorly characterized minor industrial discharges to storm drains, possible toxics in sewage treatment effluent (Vint Hill Farms), uncertain status of underground storage tank integrity and/or fuel spill containment protection (Fort Belvoir and Andrews AFB), erosion and sedimentation (Fort Belvoir and Andrews AFB), and potential contaminants leaching to surface waters from inactive waste disposal sites. In general, little data exists to adequately quantify pollutant sources and potential impact levels from these activities.

The most beneficial programs at DoD installations in this region for pollution control and environmental enhancement have included the elimination of sewage treatment systems (Fort Belvoir, Andrews AFB), implementation of erosion controls, provision of tight pesticides management, updating and implementing effective SPCC programs, preservation of large undeveloped areas which act as buffer zones for surface water habitat protection (Fort Belvoir, HDL-Woodridge, Naval Communications Unit), and development and implementation of progressive natural resource and land management programs.

Ongoing areas of concern at many of the DoD installations in this region relate primarily to activities that are difficult to control or regulate. They include: overland runoff and erosion; potential contaminant migration from inactive waste disposal sites; and intermittent and poorly defined industrial discharges into storm drainage.

5.5.2.5 Region 5: Potomac River Transition Zone. The transition zone of the Potomac estuary and its tributary creeks is significant as a spawning area for the Potomac subpopulations of striped bass, white perch, shad, and clupeids. This reach has historically been impacted by excessive plant and phytoplankton populations for decades, due to overenrichment from upstream sources. Since the partial alleviation of upstream degradation in the urban area, there is indication of improvement in water quality and ecological health in this reach. This area did suffer the decline of SAV as noted elsewhere in the Bay, but the losses can be at least partially attributed to urban inputs. This reach is critical as a finfish spawning area, and is also a major population center for estuarine dependent raptors, notably the osprey and bald eagle. The State of Maryland, which has jurisdiction over the environmental aspects of these waters, discouraged the construction of a power plant in this vicinity because of possible ecological consequences.

Two DoD installations (NOS-Indian Head, and USMC-Quantico are located in this region (see Figure 5.2). NOS Indian Head was screened in Study Group 1 (significant impact potential) primarily due to the existence of industrial pollutants and high suspended solids and BOD/nutrient levels in the industrial discharges, as well as the existence of metals deposits in wetlands adjacent to Mattawoman Creek. Quantico was screened in Study Group 2 (poorly defined, likely significant impact potential) based on concerns related to possible toxics in the storm drainage system, high erosion and sedimentation rates on the installation, and limited field observations indicating, on a preliminary basis, the migration of leachate into nearby surface waters from inactive landfills. In general, there is a lack of adequate data to characterize the levels of impact and sources of contamination from these installations.

Despite these concerns, the region of influence of these installations in the Potomac River Transition Zone is probably limited to the immediate vicinity of each installation, due partially to the dilution capacity of the Potomac River. Environmentally beneficial activities at Quantico have included upgrading the sewage treatment plant to AWT with nitrification, construction of a modern fuel storage system and elimination of old spill-prone fuel storage areas, construction of a new hazardous waste storage facility and a modern sanitary landfill with a leachate collection/treatment/monitoring system, and implementation of a comprehensive natural resources and land management plan. Similarly at NOS, beneficial programs have included significant sanitary sewage system upgrades, construction of a conforming hazardous waste storage facility, improvement to oil and chemical spill control and containment systems, and implementation of a natural resources management plan which includes soil conservation practices, forestry management, and wildlife habitat development.

5.5.2.6 Region 6: Potomac River Estuary. The Potomac estuarine salinity gradient becomes evident just upstream of the Blossom Point

facility, and the traditional estuarine species such as oysters, soft-shell clam and blue crabs are found generally from the Navy Dahlgren facility downstream. The shellfisheries and the finfisheries in the area are in general decline, as in the rest of the Bay. Submerged aquatic vegetation has disappeared from these reaches. Except for an increase in phytoplankton blooms, water quality is generally good. This is a nursery area for estuarine and marine spawning fishes. The two DoD facilities (see Figure 5.2) probably have little involvement in the far-field trends in this reach.

Near the confluence of the Potomac with the Bay, near the Naval Electronic Systems Engineering (NESEA) facility (see Figure 5.2) is one of the few remaining areas of extraordinary reproductive success for oysters, so-called "seed oyster beds". While diminished in extent over the past few decades, it is one of the few remaining in Maryland waters.

A relatively deep trench runs up this reach, and this configuration often leads to stratification in summer, with oxygen poor waters below the density discontinuity. The potential exists for increased environmental threat from increased phytoplankton production loading the bottom waters, with resultant further depletion of oxygen. NESEA is a relatively small DoD facility, and probably has no significant effect on these phenomena.

HDL-Blossom Point was screened in Study Group 1. Areas of concern at Blossom Point include widespread ordnance impact, exposure of a landfill by shoreline and bluff erosion and possible exposure by same of additional landfills and/or septic systems, and uncertain status of contaminant migration from several inactive landfills and burn/detonation pits. NSWC-Dahlgren, screened in Study Group 2, also exhibits concerns relating to the widespread impact from ordnance firing, as well as stormwater runoff, and potential contaminant migration into local wetlands from past discharges from industrial operations (gun barrel decoppering and degreasing). In general, there is a lack of adequate data to characterize the levels of impact and sources of contamination from these two installations.

Other than the widespread scattering of ordnance at Blossom Point and over a large area of th Potomac River near Dahlgren, the region of influence of these installations in the Potomac River estuary is probably limited to the immediate vicinity of each installation. Environmentally beneficial activities at Blossom Point are essentially the non-development of this site which has helped to maintain a rich diversity of habitat and utilization by wildlife, waterfowl and fish. Positive activities at Dahlgren have included several upgrades to the sewage treatment systems, construction of a new hazardous waste storage facility, and development of an active natural resources program, including soil conservation and habitat enhancement and protection.

5.5.2.7 **Region 7: Rappahannock River**. The Rappahannock River watershed is primarily an agricultural and forested area with little

development. The river serves as spawning and nursery grounds for a number of anadromous and marine species and the non-tidal freshwater portion supports a high diversity of freshwater fish. Specific water quality problems observed in the Rappahannock River include elevated fecal coliform levels, seasonally low dissolved oxygen, and nutrient enrichment. The CBP concluded that phosphorous and total nitrogen enrichment in this area were due primarily to nonpoint sources including both agricultural and forestry-related activities.

Fort A.P. Hill is the only DoD installation in the Rappahannock River Basin (see Figure 5.2). Pollutant loading contributions to the Rappahannock and York Rivers from A.P. Hill are believed insignificant, with the possible exception of sedimentation. The erosion of disturbed areas on A.P. Hill is mitigated to a large degree by the trapping of the sediment in natural retention basins formed by the ponds and lakes on the installation. Erosion is still a potential problem that needs to be adequately addressed to prevent future adverse impacts on vicinity water quality. The environmental management staff at A.P. Hill has made considerable progress in cleaning up past pollutant sources and spills, and has maintained a very active natural resources program to limit erosion and to enhance local wildlife habitats.

5.5.2.8 **<u>Region 8: York River Estuary</u>**. The four DoD installations on the lower York estuary (see Figure 5.2) front on commercial and recreational finfishing and shellfishing grounds. This area has lost most of the SAV. There have been increasing indications of dissolved oxygen deficiencies in bottom waters due partially to geomorphology, with the existence of natural basins or trenches impeding circulation. Increased phytoplankton production contributes organic matter, increasing oxygen demand in bottom waters. While the DoD facilities are not directly involved, the management concepts most applicable here to prevent far-field impacts are those of controlling nutrient input from nonpoint sources as well as point sources.

Back River, abutting the Langley facility (see Figure 5.2), has experienced many of the environmental declines noted elsewhere in the Bay, notably the loss of SAV. The presence of the Air Force facility does not, however, seem to conflict with the environmental amenities of this embayment.

NSC-Yorktown and NWS-Yorktown were screened in Study Group 1 (significant impact potential). Areas of concern for these installations include: limited evidence of the migration of toxic contaminants from inactive waste disposal or spill sites into local surface waters, where preliminary observations indicate contaminant levels exceeding Federal and State criteria; questionable quality of discharges from storm drainage and miscellaneous industrial activities; the existence of leaking underground fuel storage tanks; and deficiencies in hazardous waste storage and handling (NWS-Yorktown). Two installations (NSC-Cheatham Annex and Langley AFB) were assigned to Study Group 2 (poorly defined, likely significant adverse impact

potential). At NSC-Cheatham Annex, unresolved areas of concern include status of ongoing monitoring of NACIP inactive waste sites, and a severe shoreline erosion condition. At Langley AFB, concerns relate primarily to poorly defined storm water runoff quality/quantity, existence of occasional fuel spills reaching drainage areas not fully contained, and lack of a stormwater management plan.

The region of influence of the DoD installations appears to be limited to the immediate vicinity of each installation. Compared to the surrounding point and nonpoint pollutant sources, these installations contribute an insignificant loading of conventional pollutants (BOD, nutrients, sediments) to the Chesapeake Bay. The most beneficial activities or programs at these installations for pollution control and environmental enhancement have included natural resources management (NSC Cheatham Annex and Langley AFB), pesticides/herbicides management (Langley AFB), and deactivation of sewage treatment systems (NWS Yorktown, NSC Cheatham Annex in FY88, Camp Peary in FY89). Ongoing areas of concern at these installations relate primarily to activities that are difficult to control or regulate (i.e., shoreline erosion, stormwater runoff, and inactive hazardous waste disposal or past spill sites).

5.5.2.9 **<u>Region 9: James River Estuary</u>**. The upper James River Estuary is impacted by the urbanized Richmond area and surrounding agricultural activities. General water quality conditions are improving in this area, but are still relatively poor. Downstream from Richmond about 22 miles, at the confluence with the Appomattox River, the Hopewell area further impacts the tidal fresh waters with discharge from paper, fertilizer, chemical and tobacco processing plants. The Hopewell area was the site of the illegal Kepone (a toxic pesticide) discharges of a decade ago, which have resulted in the James River estuary being closed to commercial finfishing to this day.

The James River estuary just below Ft. Eustis is the largest "seed oyster" area remaining in Chesapeake Bay. Although oysters will grow in most areas of suitable salinity and substrate, areas of significant natural reproduction are declining. As a result, the "seed oyster" industry, in which blank shells are placed overboard in late spring to catch oyster spat then later removed to growing areas, is increasingly significant. This area is a treasured resource in Virginia.

Contamination of the James River estuary by the toxic compound Kepone is primarily upstream of this area, and is apparently being slowly buried in bottom sediments. A state surveillance system is in effect.

This area has also lost most of the SAV, but does not seem to be seriously affected by accelerated eutrophication.

The Hampton Roads area, downstream from the oyster seed beds, has a significant hard clam and finfishery, and although bottom sediments are elevated in heavy metals, this has not yet conflicted with the

fisheries. The urban and industrial development at Hampton-Newport News, including the Naval facilities at Sewells Point, apparently have little effect on these open waters. Generally, the substantial tidal exchange of this area contributes to the assimilative capacity of these waters and maintains the generally good water quality.

Water quality and benthic conditions in the Elizabeth river, especially the south branch, are generally degraded due to the intense commercial, industrial and urban use of adjacent lands. Surprisingly, the upper reaches of these subtributaries are still viable spawning and nursery areas for certain finfishes. In addition, they are utilized by the estuarine dependent raptors, notably the osprey. The environmental management practices in this area are more concentrated on spillage prevention, point source controls, waste pretreatment, dredging and spoiling, etc., in contrast to eutrophication control in upper reaches of the Bay system. DoD facilities occupy a significant proportion of the adjacent lands in the area, in the midst of heavy civilian industrial and commercial operations in an urban setting. Because of the degraded conditions of this area, the inability of the waterway to readily flush itself, and the high concentration of military activities, environmental management of Federal facilities is of greater importance than most of the other aggregations of DoD installations under consideration.

Two of the installations in this region (Sewells Point Navy Complex, Naval Shipyard Norfolk) were estimated to represent a significant adverse impact potential for local water quality (Study Group 1). Areas of concern include:

- o Preliminary evidence of the migration of toxic contaminants from inactive waste disposal or past spill sites into local surface waters, with contaminant levels exceeding Federal and State criteria;

- o Questionable quality of discharges from storm drainage and miscellaneous industrial activities;

- o Introduction of pollutants from ship maintenance activities; and

- o The existence of leaking underground fuel storage tanks.

Three of the installations (Defense General Supply Center, Fort Eustis, and Naval Supply Center-Craney Island) were estimated to represent a poorly defined but likely significant impact potential (Study Group 2). Areas of concern for these three installations are similar to the previously listed concerns (contaminant migration, storm water runoff, and fuel leakage/spills). In general, there is a lack of adequate data to quantify pollutant sources and the potential impact levels from these activities. The remaining three installations (Fort Lee, Fort Monroe, St. Julien's Creek Annex) were estimated to represent an insignificant potential for water quality impacts, based on the available information.

The region of influence of the DoD installations appears to be limited to the immediate vicinity of each installation, since there are no major point sources at any of these facilities. The most beneficial programs at DoD installations in this region for pollution control and environmental enhancement have included elimination of industrial discharges by connection to regional sewer systems (Sewells point) with similar plans at NSC Craney Island and Norfolk Naval Shipyard, implementation of effluent toxics monitoring programs (Sewells Point, Fort Eustis), and implementing upgrades to sanitary and industrial waste water treatment systems (Fort Eustis, Craney Island, Naval Shipyard Norfolk).

Ongoing areas of concern at DoD installations in this region relate primarily to activities that are difficult to control or regulate. They include: stormwater runoff; dispersed intermittent sources of industrial (toxic) pollutants to sewage treatment systems and/or to storm drains; and inactive hazardous waste disposal or past spill sites.

5.5.2.10 <u>Region 10: Mouth of Bay</u>. This region is host to three DoD installations (see Figure 5.2) two of which (NAB-Little Creek, NAS-Oceana) are major industrial activities. The Naval Amphibious Base dominates the small tributary, Little Creek, located near the mouth of the Bay. Other smaller industrial activities are also located on the embayment. The harbor is dredged for large vessels and is largely bulkheaded. Consequently, it is susceptible to stratification and stagnation. In spite of the nature and intensity of development in this area, water quality remains generally good.

NAS-Oceana bounds on the east side of "Canal #2", which feeds into Linkhorn Bay, to Broad Bay, through the "narrows" to Lynnhaven Bay. Although the area is increasingly suburban and urban, the subestuary is widely used for sport boating and fishing. Water quality is generally fair, but flushing times in the headwaters are relatively slow.

Of the three installations in this region, two (NAS-Oceana and NAB-Little Creek) were estimated to represent a likely significant potential for adverse water quality impacts. Fort Story was estimated to have a likely insignificant impact potential. NAS-Oceana was screened in Study Group 1 (significant impact potential, adverse), and NAB Little Creek in Study Group 2 (poorly defined but likely significant impact potential, adverse). Areas of concern for these two installations are similar, and include potential contaminant migration from several hazardous waste disposal and past spill sites adjacent to surface waters, questionable adequacy of stormwater runoff and fuel spill containment controls, and for NAB Little Creek, need to control contaminants from ship sand blasting activities. Currently available data are generally insufficient to determine the degree of impact from these activities. As is the case at most of the DoD installations, the above activities relate primarily to pollutant sources that are difficult to control or regulate.

5.5.2.11 **Region 11: Susquehanna River**. The Susquehanna River and its tributaries account for about 50% of the freshwater inflow to the Chesapeake Bay. Along its length, the Susquehanna flows thorough undeveloped mountain habitats, agricultural land, coal mining areas, urban and suburban settings, and heavy industry. Water quality in the mainstem Susquehanna, because of the relatively large volume, is generally good.

There are three DoD installations located in this region, including Carlisle Barracks, New Cumberland Army Depot, and Navy Ship Parts Control Center (see Figure 5.2). The former two installations were estimated to represent a likely insignificant impact potential for surface water quality. NSPCC was found to represent a poorly defined but likely significant impact potential (Study Group 2), based on a number of concerns including stormwater runoff from ore piles and from impervious surfaces, potential for migration of trace organics to local surface drainage from past spill areas, and potential contamination from remote septic systems. Little data exist, however, to verify the level of impact of NSPCC on the quality of local receiving waters.

In general, the overall effect of DoD activities on the Susquehanna River are believed to be insignificant, based on the findings of this study.

5.5.2.12 **Region 12: Non-Tidal Patuxent River**. The non-tidal Patuxent River originates in the Piedmont nearly at the Fall Line and flows southeastward, parallel to the mainstem Chesapeake Bay. Extensive development exists in the Baltimore-Washington corridor upriver from Ft. Meade, and the river receives treated sewage above, at, and downstream of this installation. It has been estimated that at summer low flow conditions, half the freshwater input to the estuary is treated sewage. EPA characterizes water quality in the lower river as fair, with enrichment of nutrients, toxics, high turbidity, and accelerated siltation. Other DoD installations in this region which drain to the Patuxent River include the U.S. Naval Academy Dairy Farm, Davidsonville RDV, and Brandywine Receiving and Housing Annex (see Figure 5.2). These facilities are on a riverine system nearly loaded to its carrying capacity for treated wastes. Allocation of the assimilative capacity of this system must therefore be carefully managed.

Three of the four DoD installations in this region were estimated to represent a likely insignificant impact potential for surface water quality. The fourth installation, Fort Meade, was screened in Study Group 2 (poorly defined but likely significant impact potential). Areas of concern at Fort Meade include leachate migration from the active sanitary landfill, control of erosion and sedimentation and subsequent effects on local sensitive habitat, and non-conforming hazardous waste disposal practices. In comparison to the Patuxent River basin-wide practices, the DoD installations in this region have a minor effect on surface water quality based on presently available information.

Beneficial practices at DoD installations in this region include implementation of progressive land management and natural resources plans (Fort Meade), upgrading of sewage treatment systems (Fort Meade, Brandywine RDV), and clean-up of POL and pesticide storage areas (Fort Meade, Davidsonville RDV). In addition, a lagoon has been constructed at the Naval Academy Dairy Farm to manage the runoff from its barns to eliminate potential coliform contamination. The lagoon, in turn, is used for irrigation purposes.

5.5.2.13 **Region 13: Non-Tidal Potomac River**. The non-tidal Potomac River and its tributaries and branches originate in the Blue Ridge and Appalachian Mountain regions, and flow generally southeasterly through the Piedmont region to the Fall Line at Washington, D.C. The land is primarily forested or agricultural, with few sizeable urban areas. Generally, water quality is good, with localized problems of acid mine drainage (low pH), sewage (bacterial) contamination, and agricultural runoff (nutrients, sediments, and organic material).

Five DoD installations operate in the non-tidal Potomac Region (see Figure 5.2). Three of these installations (NAVRADSTA-Sugar Grove, Fort Ritchie, and Fort Detrick) were estimated to represent a likely insignificant impact potential for local surface water quality. These installations appear to be well managed and have generally minimal pollutant sources. Letterkenny Army Depot (LEAD), located at the drainage divide between the Potomac and Susquehanna Rivers, was estimated to represent a poorly defined but likely significant impact potential (Study Group 2), due to contaminant sources known to exist at LEAD. Areas of concern at LEAD include possible existence of toxics in the storm drainage system, erosion from disturbed areas, runoff of nutrients and pesticides from agricultural out-lease areas, and significant on and off-post groundwater contamination from several inactive waste disposal sites. The primary beneficial aspect of LEAD's operation relate to the preservation of large areas on the installation as natural (forested) habitat, as this tends to reduce runoff of sediments, nutrients and pesticides in a region of concentrated agricultural activity.

Allegany Ballistics Lab (ABL) was also assigned to Study Group 2. Areas of concern at ABL include erosion from a solid propellant test area, lack of an active NPDES permit and recurring violations for TSS and fecal coliforms at the sewage treatment plant, and potential migration of priority pollutants and metals from several inactive waste disposal sites adjacent to the Potomac River. Although no data exist downstream of ABL in the Potomac River, the large dilution capacity of the river is believed adequate to minimize any pollutant loadings from ABL.

5.5.3 Overview

The DoD installations on the Chesapeake Bay, singly or in aggregate, do not seem to be implicitly involved in the far-field, long term trends of

declining environmental integrity of the Bay ecosystem. However, information to date indicates more careful management of all lands adjacent to the estuary will be required to reverse these trends. Restoration and protection plans have been instituted by Federal and State agencies, and DoD facility management should be in accord with these initiatives.

Three areas are identified in which special diligence should be exercised: (1) the unique finfish spawning grounds at the head of the Bay; (2) a similar unique environment in the Potomac estuary from Indian Head to Dahlgren; and (3) the Elizabeth River system, in the reaches with seriously degraded environmental conditions.

Generally, the DoD facilities are aware of the environmental status of the Chesapeake Bay and have active environmental management programs. Some of the larger installations, i.e., Aberdeen Proving Ground, USMC-Quantico, and Fort Eustis, for example, probably function as an environmental asset by precluding intense waterfront development. Certain installations have particularly aggressive natural resource and land management plans. For example, Aberdeen Proving Ground performs extensive SAV planting. Fort Meade provides a major outdoor recreational area (hunting, fishing, hiking) for the public in the crowded Baltimore-Washington corridor. Fort Belvoir has established a major wildlife habitat (Accotink Wildlife Sanctuary), as has Quantico (Chopawamsic Creek).

5.6 SUMMARY OF DOD IMPACTS BY SERVICE AND MAJOR COMMAND

5.6.1 Introduction

This section summarizes the relative impact potential of DoD activities on the Chesapeake Bay by Service and Major Command. Of the fifteen installation complexes in Study Group 1, twelve are Navy and three are Army. Of the sixteen installations in Study Group 2, eight are Navy, five are Army, two are Air Force, and one is DLA. The higher frequency of Navy installations in these two Study Groups reflects the fact that there are more Navy installations operating in the Bay than all other Services combined (37 vs. 29). The following sections summarize DoD installation impacts by Service and Major Command.

5.6.2 U.S. Navy Installations

5.6.2.1 Summary of CHESDIV Installation Impacts. CHESDIV is a regional division under the Naval Facilities Engineering Command (NAVFAC), located in Washington, D.C. There are a total of 20 Naval installations under CHESDIV command included in this study. They represent the largest group (30%) of DoD installations operating in the Chesapeake Bay drainage area. Figure 5.3 shows the approximate locations of these CHESDIV installations in the Chesapeake Bay, and lists these installations by study code number and by Study Group.

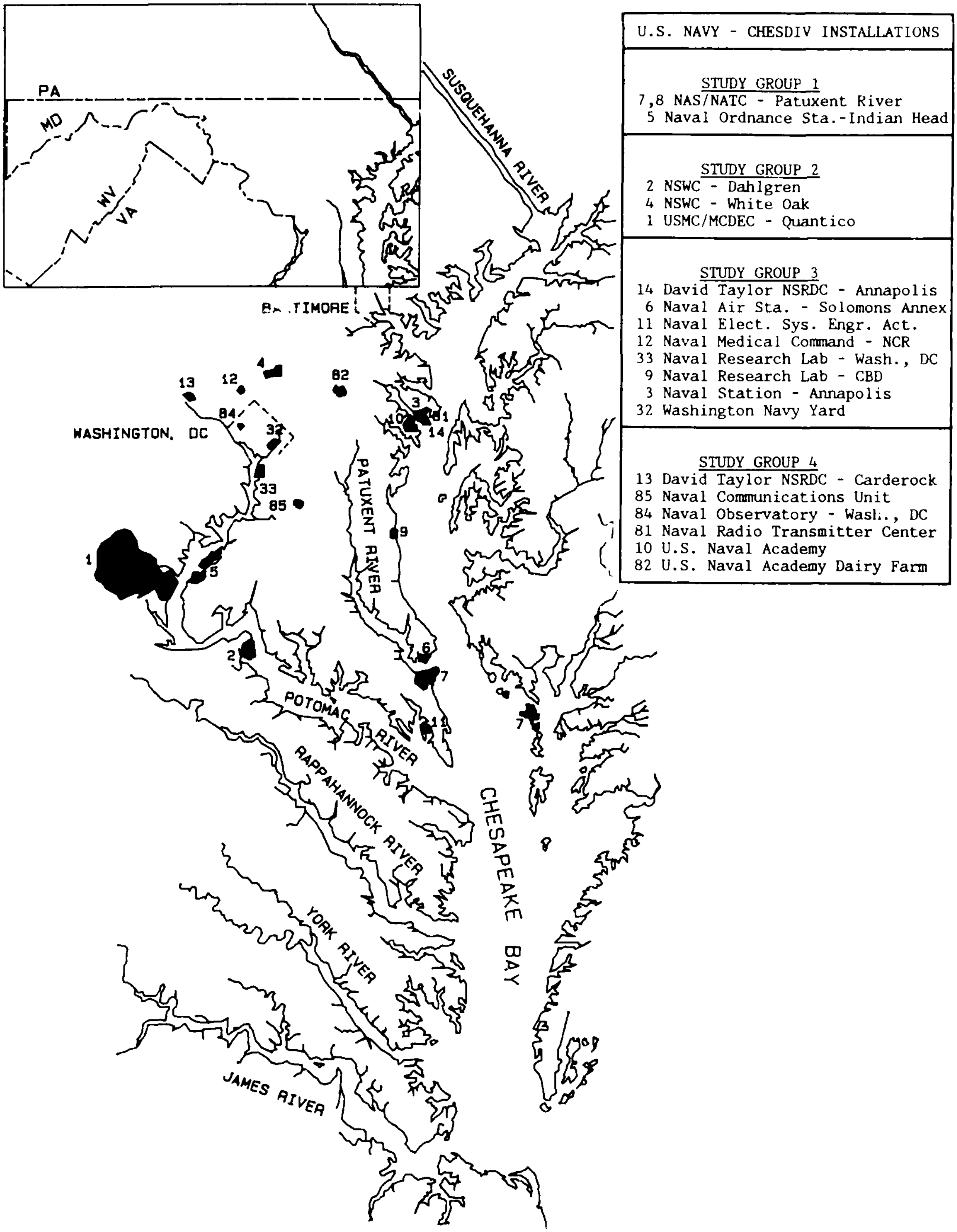


Figure 5.3 Locations of U.S. Navy CHESDIV Installations in the Chesapeake Bay Region and Summary of Installation Impact Potential.

Of the 20 CHESDIV installations, 11 were estimated during Phase I of this study to represent an insignificant potential for water quality impacts. The remaining nine--Naval Station Annapolis, DTNSRDC Annapolis, NAS/NATC Patuxent (complex of two installations), NSW White Oak, DTNSRDC Carderock, MCDEC Quantico, NOS Indian Head, and NSWC Dahlgren were judged to represent a likely significant potential for adverse water quality impacts by virtue of their activities, and were examined in greater detail during Phases II and III of this study. Presented below is a brief summary of the findings for these installations.

Table 5.7 presents the results of the final screening of the 20 CHESDIV installations. Three of the 20 installations, NAS/NATC Patuxent (complex of two installations) and NOS Indian Head were judged to represent a significant adverse impact potential for local water quality and biological resources. Major concerns at these installations include the existence of inactive waste disposal or past spill sites which exhibit a significant potential for the migration of toxic pollutants to surface waters, as well as poorly characterized waste effluent discharged from industrial activities. Three of the installations, NSWC White Oak, MCDEC Quantico, and NSWC Dahlgren were judged to represent a poorly defined but likely significant adverse impact potential for reasons similar to those discussed above. Lack of appropriate data exists to quantify or verify the impact level, if any, from these latter three installations. The remaining 14 installations, including Naval Station Annapolis, DTNSRDC Annapolis, and DTNSRDC Carderock, were estimated to represent an insignificant potential for water quality impacts, based on the available information.

With the exception of the Naval Surface Weapons Center at Dahlgren, the region of influence of the CHESDIV installations appears to be limited to the immediate vicinity of each installation. Dahlgren, however, is unique because of the impacts of ordnance shelling over a large test range in the mainstream Potomac estuary. Compared to surrounding point and nonpoint sources, the CHESDIV installations contribute an insignificant loading of conventional pollutants (BOD, nutrients, sediments) to the Chesapeake Bay. The most beneficial programs at the CHESDIV installations for pollution control and environmental enhancement have included: shoreline erosion controls; sewage treatment upgrades or elimination; control of pesticides; upgrading hazardous waste storage facilities; implementation of spill prevention and control measures; and the development and implementation of natural resources and land management plans. With some exceptions, the environmental management programs at CHESDIV installations appear to be tightly managed with considerable support and guidance given by the Engineering Field Division of NAVFAC CHESDIV. Exceptions have involved high turnover rates of environmental coordinators at some installations (DTNSRDC, NAS/NATC Patuxent, for example) which have affected the continuity and thoroughness of these environmental programs.

Table 5.7 Summary of Final Screening for CHESDIV Installations

ID	Branch	Installation Name	ON-SITE SCREENING CRITERIA (ON-SITE IMPACT POTENTIAL)																							
			NON-POINT SOURCES				POINT SOURCES			HAZARDOUS/TOXIC MATERIALS											ENVIRONMENTAL PROGRAMS					
			1. Erosion/Sedimentation	2. Impervious Area Runoff	3. Combined Storm Drains	4. Shoreline Erosion	5. Sewage Treatment	6. Industrial Waste Treat	7. Intermitt Sewage Treat	8. Refueling Operations	9. Munitions Operations	10. Chemical Operations	11. Pesticides	12. Vehicle Maintenance	13. Ship Maintenance	14. Solid Waste Disposal	15. Hazardous Waste	16. SPCC Status	17. Abandoned Sites	18. LUST Status	19. Forestry Mgmt. Plan	20. Wildlife Mgmt. Plan	21. Soil Conservation Plan	22. Stormwater Mgmt. Plan	23. Wetlands Mgmt. Plan	24. Shoreline Erosion Plan
3	NAVY	Naval Station-Annap.	+	·	·	+	+	·	·	·	·	·	·	·	-	·	·	·	·	·	+	⊕	+	·	+	-
10	NAVY	US Naval Academy	·	-	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	+	+	-	+	·
13	NAVY	David Taylor-Carder.	·	·	·	·	·	·	·	·	·	·	·	·	·	·	-	+	·	-	·	·	·	-	·	·
81	NAVY	Nav Rad Trn Fac-Annap	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·
9	NAVY	Naval Res Lab-CB Det.	·	·	·	-	⊕	·	·	·	·	·	·	·	·	·	·	+	-	·	+	+	+	+	+	+
7	NAVY	Naval Air Sta-Pax Riv	-	-	·	-	·	-	·	Θ	-	·	+	-	·	-	-	-	Θ	-	+	⊕	+	-	+	+
6	NAVY	Naval Air Sta-Sol Anx	+	·	·	+	·	·	·	·	·	·	·	·	+	·	·	+	·	·	+	+	+	+	+	+
4	NAVY	Nav Sur Wea Ctr-W Oak	-	-	·	·	+	-	-	·	·	·	+	·	·	·	+	+	-	·	+	+	+	-	·	·
12	NAVY	Naval Med. Com-NCR	⊕	·	-	·	·	-	·	-	·	·	·	·	·	·	-	-	·	·	·	·	·	-	·	·
14	NAVY	David Taylor-Annap.	+	-	-	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·
32	NAVY	Washington Navy Yard	·	-	·	·	·	·	·	-	·	·	-	·	·	·	·	-	·	-	·	·	-	+	·	+
33	NAVY	Naval Research Lab	·	-	·	+	·	-	·	·	·	·	+	·	·	·	+	+	·	·	·	·	+	+	·	+
84	NAVY	Naval Observatory	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	+	⊕	·	·	·	·

ID	Branch	Installation Name	VICINITY SCREENING CRITERIA: RELATIONSHIP TO LOCAL ENVIRONMENT							STUDY GROUP: IMPACT POTENTIAL			
			25. Shellfish Areas	26. SAV Areas	27. Fish Spawning Areas	28. Wetlands Areas	29. Waterfowl Nesting	30. Endangered Species	31. Relative Local Impact	1. Significant	2. Poorly Defined, Sig.	3. Poorly Defined, Insig.	4. Insignificant
3	NAVY	Naval Station-Annap.	-	·	-	+	·	·	+			X	
10	NAVY	US Naval Academy	-	·	-	-	·	·	·				X
13	NAVY	David Taylor-Carder.	·	·	·	·	·	·	·				X
81	NAVY	Nav Rad Trn Fac-Annap	-	·	-	+	·	·	+				X
9	NAVY	Naval Res Lab-CB Det.	+	·	·	·	·	·	+			X	
7	NAVY	Naval Air Sta-Pax Riv	-	-	-	-	+	+	Θ	X			
6	NAVY	Naval Air Sta-Sol Anx	-	-	-	-	-	-	·			X	
4	NAVY	Nav Sur Wea Ctr-W Oak	·	·	-	·	·	·	-		X		
12	NAVY	Naval Med. Com-NCR	·	·	·	·	·	·	-			X	
14	NAVY	David Taylor-Annap.	-	·	-	·	·	·	+			X	
32	NAVY	Washington Navy Yard	·	·	-	·	·	·	·			X	
33	NAVY	Naval Research Lab	·	·	-	·	·	·	·			X	
84	NAVY	Naval Observatory	·	·	·	·	·	·	·				X

KEY: Impact Category 1:
- Θ Significant Impact Potential (Adverse)
- ⊕ Significant Impact Potential (Beneficial)

Impact Category 2:
- \- Unknown or Poorly Defined Impacts (Adverse)
- \+ Unknown or Poorly Defined Impacts (Beneficial)

Impact Category 3:
- · Insignificant Impact Potential (Adverse or Beneficial)

Table 5.7
(Continued)

ID	Branch	Installation Name	ON-SITE SCREENING CRITERIA (ON-SITE IMPACT POTENTIAL)																								VICINITY SCREENING CRITERIA							STUDY GROUP			
			NON-POINT SOURCES				POINT SOURCES			HAZARDOUS/TOXIC MATERIALS											ENVIRON-MENTAL PROGRAMS						RELATIONSHIP TO LOCAL ENVIRONMENT							IMPACT POTENTIAL			
			1. Erosion/Sedimentation	2. Impervious Area Runoff	3. Combined Storm Drains	4. Shoreline Erosion	5. Sewage Treatment	6. Industrial Waste Treat	7. Remote Sewage Treatmnt	8. Refueling Operations	9. Munitions Operations	10. Chemical Operations	11. Pesticides	12. Vehicle Maintenance	13. Ship Maintenance	14. Solid Waste Disposal	15. Hazardous Waste	16. SPCC Status	17. Abandoned Sites	18. LUST Status	19. Forestry Mgmt. Plan	20. Wildlife Mgmt. Plan	21. Soil Conservation Plan	22. Stormwater Mgmt. Plan	23. Wetlands Mgmt. Plan	24. Shoreline Erosion Plan	25. Shellfish Areas	26. SAV Areas	27. Fish Spawning Areas	28. Wetlands Areas	29. Waterfowl Nesting	30. Endangered Species	31. Relative Local Impact	1. Significant	2. Poorly Defined, Sig.	3. Poorly Defined, Insig.	4. Insignificant
85	NAVY	Naval Com. Unit	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	-	·	·	·	·	·	·	·	⊕	·	·	·				X
1	NAVY	USMC - Quantico	-	-	Θ	·	+	·	·	⊕	·	·	·	+	·	⊕	-	⊕	Θ	-	⊕	+	-	-	-	·	·	-	-	-	⊕	⊕	+		X		
5	NAVY	Naval Ordnance Sta.	·	·	Θ	Θ	+	-	·	·	Θ	·	·	·	·	·	+	+	Θ	·	+	+	·	·	+	-	·	-	-	-	·	·	Θ	X			
2	NAVY	Nav Sur Wea Ctr-Dahl.	+	-	-	+	+	-	·	-	Θ	-	+	·	·	·	+	+	Θ	·	+	+	+	+	+	+	-	-	-	-	-	-	-		X		
11	NAVY	Naval Elect. Sys Eng	+	·	·	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	+	+	+	+	+	+	+	-	-	+	+	+	·			X	
82	NAVY	Naval Academy Farm	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	⊕	+	·	·	·	·	·	·	·	·	·				X
		Total Number of Installations Per Study Group																																2	3	8	6
		Score Totals Θ	-	-	2	1	-	-	-	1	2	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	2				
		Score Totals -	3	8	3	2	-	6	1	3	1	1	1	1	1	1	4	3	2	4	-	1	2	6	1	2	7	5	12	6	2	2	3				
		Score Totals ⊕	1	-	-	-	1	-	-	1	-	-	-	-	-	1	-	1	-	-	1	3	1	-	-	-	-	-	-	1	1	1	-				
		Score Totals +	5	-	1	5	6	-	-	-	-	-	5	1	1	-	4	8	1	-	10	8	9	7	9	7	2	-	-	3	2	2	5				
		Score Totals ·	10	11	13	11	12	13	18	14	16	18	13	17	17	17	11	7	12	15	8	7	7	6	9	10	10	14	7	9	14	14	9				

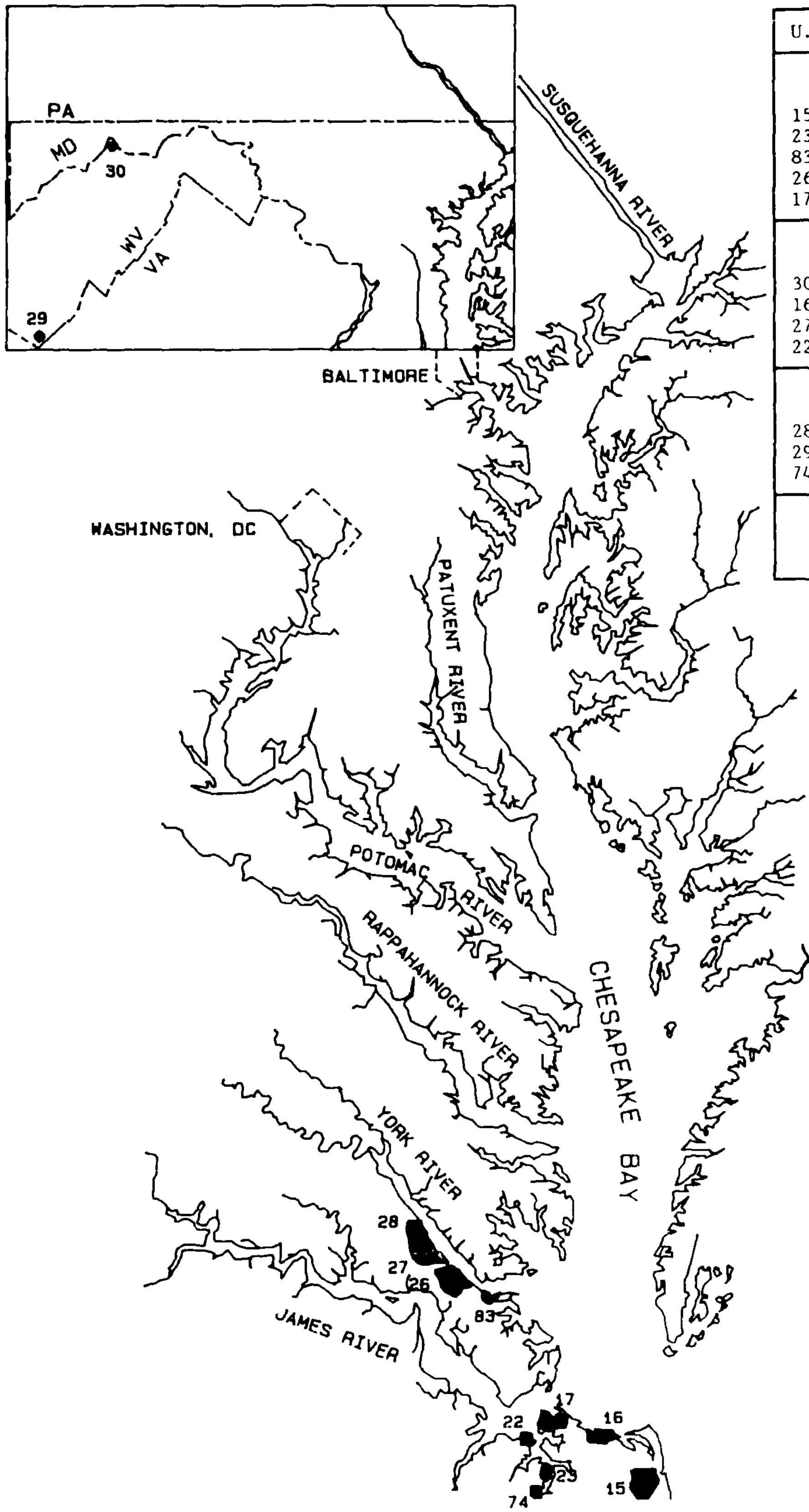
Ongoing areas of concern at the CHESDIV installations relate primarily to activities that are difficult to control or regulate. They include: shoreline erosion; stormwater runoff; dispersed intermittent sources of industrial (toxic) pollutants to sewage treatment systems and/or to storm drains (which are permitted and tested only for conventional pollutants); and inactive hazardous waste disposal or spill sites. A number of recommendations have been developed to address these and other areas of concern at CHESDIV installations and are presented in Chapter 4.0 and summarized in Section 5.7.

5.6.2.2 **Summary of LANTDIV Installation Impacts.** LANTDIV is a regional division under the Naval Facilities Engineering Command, located in Norfolk, Virginia. There are a total of 16 LANTDIV installations included in this study. These represent approximately 24% of the DoD installations operating in the Chesapeake Bay drainage area. Figure 5.4 shows the approximate locations of the LANTDIV installations relative to the Chesapeake Bay, and lists these installations by study code number and by Study Group.

Of the 16 LANTDIV installations, three (Camp Peary, Naval Radio Station--Sugar Grove, and St. Julien's Creek Annex) were judged during Phase I of the study to represent a likely insignificant potential for water quality impacts. The remaining 13 installations were judged to represent a likely significant potential for water quality impacts by virtue of their activities, and were examined in greater detail during Phase III of this study. Presented below is a brief summary of the findings for these LANTDIV installations.

Table 5.8 presents the results of the final screening for all 16 LANTDIV installations. Nine of the 16 installations--NAS Oceana, Naval Shipyard Norfolk, Naval Supply Center Yorktown, Naval Weapons Station-Yorktown, and Sewells Point Navy Complex (complex of five installations)--were judged to represent a significant adverse impact potential for local water quality and biological resources. Typical areas of concern for these installations include: preliminary evidence based on limited data sets (data for Oceana not yet available for review) of the migration of toxic contaminants from inactive waste disposal or past spill sites into local surface waters, with contaminant levels exceeding Federal and State criteria; poorly defined quality of discharges from storm drainage and miscellaneous industrial activities; introduction of pollutants from ship maintenance activities (Sewells Point and Naval Shipyard Norfolk only); and the existence of leaking underground fuel storage tanks. Except for the Sewells Point Navy Complex, these installations are located in close proximity to valuable wetland and intertidal areas, where biological resources are highly susceptible to pollutant stress.

Four of the LANTDIV installations--NAB Little Creek, Naval Supply Center Cheatham Annex, Naval Supply Center Craney Island, and Allegheny Ballistics Lab--were found to represent a poorly defined but likely significant adverse impact potential. The most frequently occurring area of concern for these installations was the potential, based on



U.S. NAVY - LANTDIV INSTALLATIONS

STUDY GROUP 1
15 Naval Air Station - Oceana
23 Naval Shipyard - Norfolk
83 Naval Supply Center - Yorktown
26 Naval Weapons Station-Yorktown
17-21 Sewells Point Naval Complex

STUDY GROUP 2
30 Allegany Ballistics Lab
16 Naval Amph. Base - Little Creek
27 Naval Sup. Cen.-Cheatham Annex
22 Naval Sup. Cen. - Craney Island

STUDY GROUP 3
28 Camp Peary
29 Naval Radio Station-Sugar Grove
74 St. Juliens Creek Annex

STUDY GROUP 4
(none)

Figure 5.4 Locations of U.S. Navy LANTDIV Installations in the Chesapeake Bay Region and Summary of Installation Impact Potential.

Table 5.8 Summary of Final Screening for LANTDIV Installations

ON-SITE SCREENING CRITERIA (ON-SITE IMPACT POTENTIAL)

ID	Branch	Installation Name	NON-POINT SOURCES: 1. Erosion/Sedimentation	2. Impervious Area Runoff	3. Combined Storm Drains	4. Shoreline Erosion	POINT SOURCES: 5. Sewage Treatment	6. Industrial Waste Treat	7. Intermitt Sewage Treat	HAZARDOUS/TOXIC MATERIALS: 8. Refueling Operations	9. Munitions Operations	10. Chemical Operations	11. Pesticides	12. Vehicle Maintenance	13. Ship Maintenance	14. Solid Waste Disposal	15. Hazardous Waste	16. SPCC Status	17. Abandoned Sites	18. LUST Status	ENVIRONMENTAL PROGRAMS: 19. Forestry Mgmt. Plan	20. Wildlife Mgmt. Plan	21. Soil Conservation Plan	22. Stormwater Mgmt. Plan	23. Wetlands Mgmt. Plan	24. Shoreline Erosion Plan
28	NAVY	Camp Peary	-	•	•	-	+	•	•	•	•	•	•	•	•	-	•	+	•	•	+	•	+	+	+	+
15	NAVY	Naval Air Sta-Oceana	Θ	-	-	•	•	-	•	Θ	•	•	+	Θ	•	-	-	-	Θ	Θ	+	+	-	Θ	-	•
16	NAVY	Naval Amphibious Base	•	-	-	•	•	•	•	-	•	•	+	•	Θ	•	+	-	Θ	-	+	+	•	-	-	+
29	NAVY	NAVRADSTA-Sugar Grove	-	-	•	•	-	•	-	•	•	•	•	•	•	-	•	+	•	•	•	+	+	•	•	•
23	NAVY	Naval Shipyard-Norflk	•	-	•	•	•	Θ	•	•	•	Θ	•	•	Θ	Θ	Θ	-	Θ	-	•	•	•	-	-	•
27	NAVY	Naval Sup Ctr-Cht Anx	-	-	•	-	+	•	+	-	•	•	•	•	•	•	•	-	Θ	•	+	+	+	+	+	+
22	NAVY	Naval Sup Ctr-Craney	•	•	•	+	•	⊕	•	-	•	•	•	•	•	-	-	-	Θ	Θ	+	-	•	Θ	-	+
83	NAVY	Naval Sup Ctr-Yorktwn	•	•	•	•	•	•	-	-	•	•	•	•	•	•	•	+	Θ	Θ	•	•	•	Θ	Θ	•
26	NAVY	Naval Weapons Station	•	•	•	•	•	+	•	+	+	+	•	+	•	-	-	-	Θ	-	+	+	+	•	-	•
17	NAVY	Sewells Pt Navy Compx	•	Θ	Θ	•	•	+	•	Θ	•	-	•	-	Θ	•	-	-	-	-	•	•	•	-	•	•
74	NAVY	St. Juliens Cr. Annex	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	-	•	•	•	•	•	+	•
30	NAVY	Allegany Ballist. Lab	-	•	•	•	-	•	•	•	-	-	•	•	•	-	-	+	Θ	-	+	•	Θ	•	•	•

Score Totals (On-Site Screening Criteria)

Score	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.
Θ	1	1	1	0	0	1	0	2	0	1	0	1	3	1	1	0	8	3	0	0	1	3	1	0
-	4	5	2	2	2	1	2	4	1	2	0	1	0	6	5	7	2	5	0	1	1	3	5	0
⊕	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+	0	0	0	1	2	2	1	1	1	1	2	1	0	0	[illegible]	[illegible]	0	0	7	5	4	2	3	4
•	7	6	9	9	8	7	9	5	10	8	10	9	9	5	5	1	2	4	5	6	6	4	3	8

VICINITY SCREENING CRITERIA (RELATIONSHIP TO LOCAL ENVIRONMENT) and STUDY GROUP (IMPACT POTENTIAL*)

ID	Branch	Installation Name	25. Shellfish Areas	26. SAV Areas	27. Fish Spawning Areas	28. Wetlands Areas	29. Waterfowl Nesting	30. Endangered Species	31. Relative Local Impact	1. Significant	2. Poorly Defined, Sig.	3. Poorly Defined, Insig.	4. Insignificant
28	NAVY	Camp Peary	-	-	-	-	-	-	+			X	
15	NAVY	Naval Air Sta-Oceana	-	-	•	-	•	•	Θ	X			
16	NAVY	Naval Amphibious Base	Θ	•	•	Θ	•	•	-		X		
29	NAVY	NAVRADSTA-Sugar Grove	•	•	+	•	•	•	•			X	
23	NAVY	Naval Shipyard-Norflk	•	•	-	Θ	•	•	Θ	X			
27	NAVY	Naval Sup Ctr-Cht Anx	-	-	-	-	-	-	-		X		
22	NAVY	Naval Sup Ctr-Craney	Θ	•	-	-	-	•	-		X		
83	NAVY	Naval Sup Ctr-Yorktwn	-	-	-	Θ	-	•	Θ	X			
26	NAVY	Naval Weapons Station	-	-	-	-	-	•	Θ	X			
17	NAVY	Sewells Pt Navy Compx	-	•	-	•	•	•	-	X			
74	NAVY	St. Juliens Cr. Annex	•	•	-	-	•	•	•			X	
30	NAVY	Allegany Ballist. Lab	•	•	•	•	•	•	-		X		
		Total Number of Installations per Study Group								5	4	3	0

Score Totals (Vicinity Screening Criteria)

Score	25.	26.	27.	28.	29.	30.	31.
Θ	2	0	0	3	0	0	4
-	6	5	8	6	5	2	5
⊕	0	0	0	0	0	0	0
+	0	0	1	0	0	0	1
•	4	7	3	3	7	10	2

preliminary information, for the release of toxics to surface waters from inactive waste disposal or past spill sites. Other areas of concern include: contaminants in stormwater runoff; fuel leakage and uncertain status of UST's; periodic violations of NPDES permit limits; and, deficiencies in the storage and handling of hazardous wastes. Lack of appropriate data exist to quantify or verify the offsite impact level, if any, from these installations.

The remaining three LANTDIV installations, including Camp Peary, Naval Radio Station Sugar Grove, and St. Julien's Creek Annex, were judged to represent an insignificant potential for water quality impacts, based on available information.

The region of influence of the LANTDIV installations appears to be limited to the immediate vicinity of each installation. Compared to the surrounding point and nonpoint pollutant sources, the LANTDIV installations contribute an insignificant loading of conventional pollutants (BOD, nutrients, sediments) to the Chesapeake Bay. The most beneficial activities or programs at LANTDIV installations for pollution control and environmental enhancement have included: elimination of many major sewage discharges and connections into the regional sewerage system; provision of waste pretreatment and upgrades to existing pretreatment systems; upgrading hazardous waste storage and handling procedures; implementation of spill prevention and control measures; and the development and implementation of natural resources and land management plans. The environmental management programs at most LANTDIV installations appear to be aggressively pursuing solutions to the environmental concerns on these complex facilities, with considerable and effective support and guidance given by the Engineering Field Division of NAVFAC LANTDIV. A possible exception is at the Allegheny Ballistics Lab where responsibility for compliance with applicable environmental regulations is not clearly specified in the facilities operating contract with Hercules, Inc.

Ongoing areas of concern at the LANTDIV installations relate primarily to activities that are difficult to control or regulate. They include: shoreline erosion; stormwater runoff; dispersed intermittent sources of industrial (toxic) pollutants to sewage treatment systems and/or to storm drains (which are permitted and tested only for conventional pollutants); and inactive hazardous waste disposal or past spill sites. A number of recommendations have been developed to address these and other areas of concern at LANTDIV installations and are presented in Chapter 4.0 and summarized in Section 5.7.

5.6.2.3 Summary of NORTHDIV Installation Impacts. NORTHDIV is a regional division under the Naval Facilities Engineering Command, located in Philadelphia, Pennsylvania. There is one NORTHDIV installation included in this study, Navy Ships Parts Control Center (NSPCC) near Mechanicsburg, Pennsylvania. In Phase III, NSPCC was screened in Study Group 2 (poorly defined but likely significant impact potential). Areas of concern at NSPCC include: contamination of local surface waters by stormwater runoff from ore piles and impervious surfaces; potential groundwater contamination from remote septic tanks; and potential contamination of ground and surface waters from waste solvent/sludge disposal areas. There exist inadequate data in the vicinity of NSPCC to verify the extent and/or presence of contaminants in local surface waters. Beneficial activities at NSPCC have included connection of the base to the regional sewerage system and upgrading of sewage lines to eliminate extensive infiltration problems. Recommended actions for NSPCC are presented in Chapter 4.0 and summarized in Section 5.7.

5.6.3 U.S. Army Installations

5.6.3.1 Summary of AMC Installation Impacts. The U. S. Army Materiel Command (AMC) headquarters are located in Alexandria, Virginia. There are a total of seven AMC installations included in this study. This group represents 11% of the DoD installations operating in the Chesapeake Bay drainage area. Figure 5.5 shows the approximate locations of the AMC installations relative to the Chesapeake Bay, and lists these installations by study code number and by Study Group.

Of the seven AMC installations, three (Harry Diamond Labs--Woodbridge and Adelphi, and New Cumberland Depot) were estimated during Phase I of this study to represent a likely insignificant potential for water quality impacts. The remaining four installations (Aberdeen Proving Ground [complex of two installations], Harry Diamond Labs--Blossom Point, and Letterkenny Army Depot) were judged to possess a significant potential for water quality impacts by nature of their activities, and were examined in greater detail during Phase III. Presented below is a brief summary of the findings for these AMC installations.

Table 5.9 presents the results of the final screening of all seven AMC installations. Three of the seven installations--Aberdeen Proving Grounds (complex of two installations) and Harry Diamond Labs-Blossom Point--were judged to represent a significant adverse impact potential to local water quality and biological resources. Areas of concern for these two installations include: widespread contamination of wetlands and open water areas with UXO (unexploded ordnance); potential contaminant migration into adjacent surface waters from inactive landfills and from the open burning of chemicals; shoreline erosion and exposure of a landfill (HDL Blossom Point); uncertain status of NPDES discharge compliance (APG); and the existence of a white phosphorus deposit in the estuarine sediments at APG. Both of the installations are located in and adjacent to extensive wetland and intertidal areas.

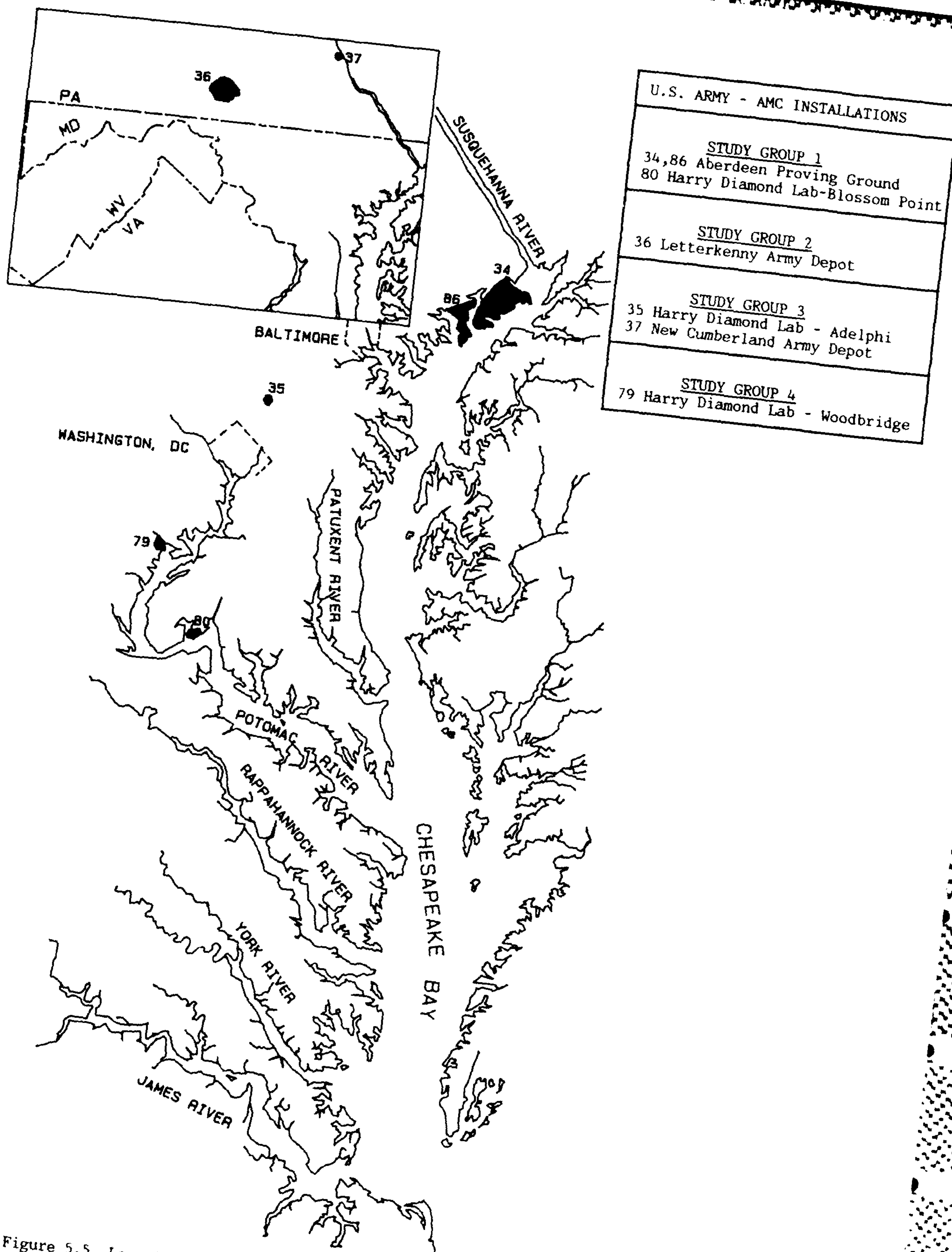


Figure 5.5 Locations of U.S. Army AMC Installations in the Chesapeake Bay Region and Summary of Installation Impact Potential.

Table 5.9 Summary of Final Screening for AMC Installations

ON-SITE SCREENING CRITERIA (ON-SITE IMPACT POTENTIAL)

ID	Branch	Installation Name	NON-POINT SOURCES: 1. Erosion/Sedimentation	2. Impervious Area Runoff	3. Combined Storm Drains	4. Shoreline Erosion	POINT SOURCES: 5. Sewage Treatment	6. Industrial Waste Treat	7. Intermitt Sewage Treat	HAZARDOUS/TOXIC MATERIALS: 8. Refueling Operations	9. Munitions Operations	10. Chemical Operations	11. Pesticides	12. Vehicle Maintenance
34	ARMY	Aberdeen Proving Grnd	+	·	-	-	-	+	·	-	Θ	Θ	+	-
35	ARMY	HDL - Adelphi	+	·	·	·	·	+	·	·	·	·	·	·
80	ARMY	HDL - Blossom Point	Θ	·	·	Θ	·	·	Θ	·	Θ	·	-	·
79	ARMY	HDL - Woodbridge	+	·	·	+	·	·	+	·	·	·	·	·
36	ARMY	Letterkenny Army Dep.	Θ	-	·	·	-	-	-	-	-	-	-	-
37	ARMY	New Cumberland Depot	·	+	·	·	+	⊕	·	+	·	⊕	·	·
Score Totals		·	1	4	5	3	3	2	3	3	3	3	3	4
		+	3	1	0	1	1	2	1	1	0	0	1	0
		⊕	0	0	0	0	0	1	0	0	0	1	0	0
		-	0	1	1	1	2	1	1	2	1	1	2	2
		Θ	2	0	0	1	0	0	1	0	2	1	0	0

ID	Branch	Installation Name	HAZARDOUS/TOXIC MATERIALS (cont.): 13. Ship Maintenance	14. Solid Waste Disposal	15. Hazardous Waste	16. SPCC Status	17. Abandoned Sites	18. LUST Status	ENVIRONMENTAL PROGRAMS: 19. Forestry Mgmt. Plan	20. Wildlife Mgmt. Plan	21. Soil Conservation Plan	22. Stormwater Mgmt. Plan	23. Wetlands Mgmt. Plan	24. Shoreline Erosion Plan
34	ARMY	Aberdeen Proving Grnd	·	·	-	+	Θ	-	+	⊕	+	-	+	-
35	ARMY	HDL - Adelphi	·	·	+	+	·	-	·	·	+	-	·	·
80	ARMY	HDL - Blossom Point	·	·	·	+	Θ	-	-	Θ	Θ	·	Θ	Θ
79	ARMY	HDL - Woodbridge	·	·	·	+	⊕	+	+	⊕	⊕	+	⊕	+
36	ARMY	Letterkenny Army Dep.	·	·	-	-	Θ	-	+	+	-	+	·	·
37	ARMY	New Cumberland Depot	·	·	+	+	+	·	·	+	+	+	⊕	·
Score Totals		·	6	6	2	0	1	1	2	1	0	1	2	3
		+	0	0	2	5	1	1	3	2	3	3	1	1
		⊕	0	0	0	0	1	0	0	2	1	0	2	0
		-	0	0	2	1	0	4	1	0	1	2	0	1
		Θ	0	0	0	0	3	0	0	1	1	0	1	1

VICINITY SCREENING CRITERIA (RELATIONSHIP TO LOCAL ENVIRONMENT) and STUDY GROUP (IMPACT POTENTIAL)

ID	Branch	Installation Name	25. Shellfish Areas	26. SAV Areas	27. Fish Spawning Areas	28. Wetlands Areas	29. Waterfowl Nesting	30. Endangered Species	31. Relative Local Impact	1. Significant	2. Poorly Defined, Sig.	3. Poorly Defined, Insig.	4. Insignificant
34	ARMY	Aberdeen Proving Grnd	·	⊕	-	-	⊕	⊕	Θ	X			
35	ARMY	HDL - Adelphi	·	·	·	·	·	·	+			X	
80	ARMY	HDL - Blossom Point	Θ	-	-	Θ	Θ	-	Θ	X			
79	ARMY	HDL - Woodbridge	+	·	⊕	⊕	⊕	⊕	+				X
36	ARMY	Letterkenny Army Dep.	·	·	·	·	·	·	-		X		
37	ARMY	New Cumberland Depot	·	·	·	⊕	⊕	·	+			X	
Total Number of Installations per Study Group										2	1	2	1
Score Totals		·	4	4	3	2	2	3	0				
		+	1	0	0	0	0	0	3				
		⊕	0	1	1	2	3	2	0				
		-	0	1	2	1	0	1	1				
		Θ	1	0	0	1	1	0	2				

KEY: Impact Category 1: { Θ Significant Impact Potential (Adverse)
⊕ Significant Impact Potential (Beneficial)

Impact Category 2: { - Unknown or Poorly Defined Impacts (Adverse)
\+ Unknown or Poorly Defined Impacts (Beneficial)

Impact Category 3: · Insignificant Impact Potential (Adverse or Beneficial)

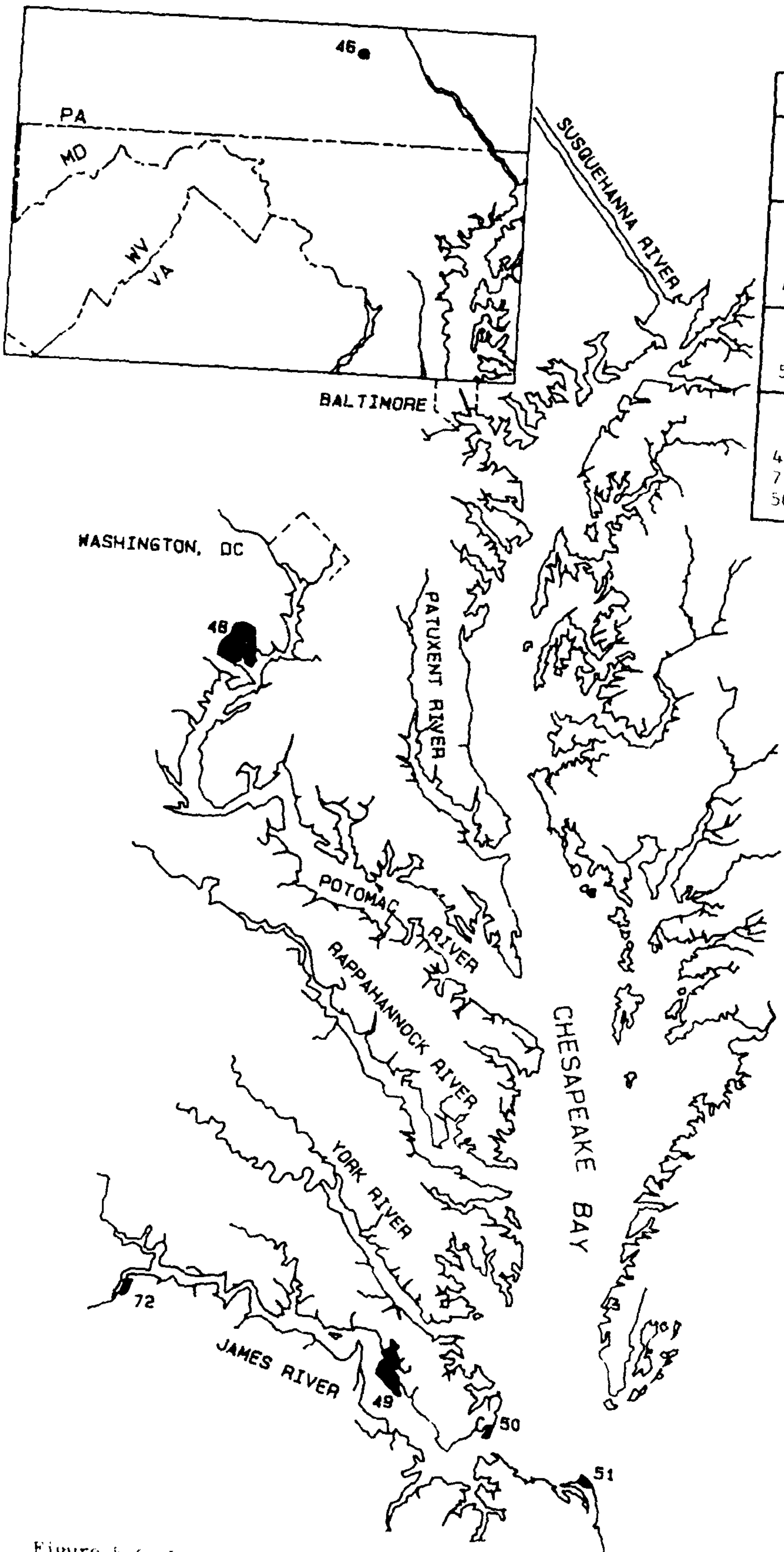
Letterkenny Army Depot, originally judged to represent a significant adverse impact potential during Phase I, was reassessed during Phase II and assigned to the category of "poorly defined but likely significant impact potential." Available data from studies performed at LEAD indicated that, despite known groundwater contamination extending offpost and across surface drainage courses, impact on surface water quality was probably minor due to rapid volatilization of the contaminants when exposed to air. Surface erosion and runoff of pesticides and nutrients from agricultural outlease areas were also identified as areas of concern at LEAD.

The remaining three installations (Harry Diamond Labs--Woodbridge and Adelphi, and New Cumberland Depot) were estimated to represent an insignificant potential for water quality impacts, based on the available information.

With the exception of the ordnance shelling activities at APG and HDL-Blossom Point, the region of influence of the AMC installations appears to be limited to the immediate vicinity of each installation. Compared to surrounding point and nonpoint sources, the AMC installations contribute an insignificant loading of conventional pollutants (BOD, nutrients, sediments) to the Chesapeake Bay. The most beneficial programs at AMC installations for pollution control and environmental enhancement have included upgrades to domestic and industrial waste treatment systems, implementation of spill prevention and control measures, improvements in hazardous waste storage and handling, development and implementation of natural resources and land management plans, and preservation of large undeveloped areas which act as buffer zones for surface water habitat protection. The environmental management programs at all the AMC installations are progressive and well managed, with considerable support and guidance given by AMC headquarters and by AEHA.

Ongoing areas of concern at the AMC installations relate primarily to activities that are difficult to control or regulate. They include: shoreline erosion; overland runoff and erosion; large areas of unexploded ordnance in wetlands in open water areas; potential contaminant migration from inactive waste disposal sites; and potential toxicity of sewage treatment effluent. A number of recommendations have been developed to address these and other areas of concern at AMC installations and are presented in Chapter 4.0 and summarized in Section 5.7.

5.6.3.2 Summary of TRADOC Installation Impacts. The U. S. Army Training and Doctrine Command is located at Fort Monroe, Virginia. There are a total of six TRADOC installations included in this study. This group represents 9% of the DoD installations operating in the Chesapeake Bay drainage area. Figure 5.6 shows the approximate locations of the TRADOC installations relative to the Chesapeake Bay, and lists these installations by study code number and by Study Group. Of the six TRADOC installations, four (Fort Lee, Fort Monroe, Fort Story, and Carlisle Barracks) were judged during Phase I of this study



U.S. ARMY - TRADOC INSTALLATIONS
STUDY GROUP 1 (none)
STUDY GROUP 2 48 Fort Belvoir 49 Fort Eustis
STUDY GROUP 3 51 Fort Story
STUDY GROUP 4 46 Carlisle Barracks 72 Fort Lee 50 Fort Monroe

Figure 5.6 Locations of U.S. Army TRADOC Installations in the Chesapeake Bay Region and Summary of Installation Impact Potential.

to represent a likely insignificant potential for water quality impacts. The remaining two installations (Fort Belvoir and Fort Eustis) were judged to possess a poorly defined but likely significant potential for water quality impacts by nature of their activities, and were examined in greater detail during Phases II and III of the study. Presented below is a brief summary of the findings for these TRADOC installations.

Table 5.10 presents the results of the final screening for all six TRADOC installations. Two of the six installations--Fort Belvoir and Fort Eustis--were judged to possess a significant adverse impact potential to local water quality and biological resources. Areas of concern for these two installations include: leachate migration from inactive landfills into local surface waters; surface erosion and stormwater runoff (Fort Belvoir); and possible toxics in the sewage treatment system (Fort Eustis). Little data exists to adequately quantify pollutant sources and potential impact levels from these activities. The remaining four installations (Fort Lee, Fort Monroe, Fort Story, and Carlisle Barracks) were judged to represent an insignificant potential for water quality impacts.

The region of influence of the TRADOC installations appears to be limited to the immediate vicinity of each installation. Compared to surrounding point and nonpoint sources, the TRADOC installations contribute an insignificant loading of conventional pollutants (BOD, nutrients, sediments) to the Chesapeake Bay. The most beneficial programs at TRADOC installations for pollution control and environmental enhancement have included: the upgrading and/or elimination of sewage treatment systems (Fort Belvoir and Fort Eustis); cleanup of past POL and chemical spills and implementation of preventative controls; preservation of large undeveloped areas which act as buffer zones for surface water habitat protection; and development and implementation of progressive natural resources and land management programs. The environmental management staffs at these installations have coordinated with AEHA on a variety of investigations to resolve environmental concerns.

Ongoing areas of concern at the TRADOC installations relate primarily to activities that are difficult to control or regulate. They include: overland runoff and erosion; potential contaminant migration from inactive waste disposal sites; intermittent and poorly defined industrial discharges into storm drainage (Fort Belvoir); and elimination of toxics in sewage treatment (Fort Eustis). A number of recommendations have been developed to address these and other areas of concern at TRADOC installations and are presented in Chapter 4.0 and summarized in Section 5.7.

5.6.3.3 Summary of MDW Installation Impacts. The U. S. Army Military District, Washington (MDW) is located at Fort McNair, Washington, D.C. There are three MDW installations included in this study--Cameron Station, Alexandria, Virginia; Fort McNair, District of Columbia; and Fort Myer, Arlington, Virginia. All three of the MDW installations,

Table 5.10 Summary of Final Screening for TRADOC Installations

ID	Branch	Installation Name	ON-SITE SCREENING CRITERIA (ON-SITE IMPACT POTENTIAL): NON-POINT SOURCES				POINT SOURCES			HAZARDOUS/TOXIC MATERIALS											ENVIRONMENTAL PROGRAMS					
			1. Erosion/Sedimentation	2. Impervious Area Runoff	3. Combined Storm Drains	4. Shoreline Erosion	5. Sewage Treatment	6. Industrial Waste Treat	7. Intermitt Sewage Treat	8. Refueling Operations	9. Munitions Operations	10. Chemical Operations	11. Pesticides	12. Vehicle Maintenance	13. Ship Maintenance	14. Solid Waste Disposal	15. Hazardous Waste	16. SPCC Status	17. Abandoned Sites	18. LUST Status	19. Forestry Mgmt. Plan	20. Wildlife Mgmt. Plan	21. Soil Conservation Plan	22. Stormwater Mgmt. Plan	23. Wetlands Mgmt. Plan	24. Shoreline Erosion Plan
48	ARMY	Fort Belvoir	+	-	-	·	·	-	·	-	-	+	+	+	·	+	Θ	-	Θ	-	+	+	+	Θ	+	-
46	ARMY	Carlisle Barracks	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	+	+	·	·
49	ARMY	Fort Eustis	·	·	·	·	-	-	·	-	·	·	·	-	-	Θ	-	·	Θ	-	+	+	·	·	+	·
72	ARMY	Fort Lee	·	·	·	·	·	·	+	-	·	·	⊕	·	·	+	·	+	·	·	+	·	+	+	·	·
50	ARMY	Fort Monroe	·	·	-	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	+
51	ARMY	Fort Story	-	·	-	-	·	·	-	-	·	·	·	-	·	·	·	·	·	-	·	·	·	·	+	-
Score Totals		Θ	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	2	0	0	0	0	1	0	0
		-	1	1	3	1	1	2	1	4	1	0	0	2	1	0	1	1	0	3	0	0	0	0	0	2
		⊕	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		+	1	0	0	0	0	0	1	0	0	1	2	1	0	2	0	2	0	0	3	2	3	2	4	1
		·	4	5	3	5	5	4	4	2	5	5	4	3	5	3	4	3	4	3	3	4	3	3	2	3

ID	Branch	Installation Name	VICINITY SCREENING CRITERIA: RELATIONSHIP TO LOCAL ENVIRONMENT							STUDY GROUP: IMPACT POTENTIAL*			
			25. Shellfish Areas	26. SAV Areas	27. Fish Spawning Areas	28. Wetlands Areas	29. Waterfowl Nesting	30. Endangered Species	31. Relative Local Impact	1. Significant	2. Poorly Defined, Sig.	3. Poorly Defined, Insig.	4. Insignificant
48	ARMY	Fort Belvoir	·	-	-	-	⊕	-	-		X		
46	ARMY	Carlisle Barracks	·	·	·	·	·	·	·				X
49	ARMY	Fort Eustis	Θ	·	·	⊕	⊕	·	-		X		
72	ARMY	Fort Lee	·	·	·	·	·	·	+				Y
50	ARMY	Fort Monroe	·	·	·	+	·	·	·				X
51	ARMY	Fort Story	-	·	-	+	+	·	·			X	
Total Number of Installations per Study Group =										0	2	1	3
Score Totals		Θ	1	0	0	0	0	0	0				
		-	1	1	2	1	0	1	2				
		⊕	0	0	0	1	1	0	0				
		+	0	0	0	2	2	0	1				
		·	4	5	4	2	3	0	3				

KEY:

Impact Category 1:
- Θ Significant Impact Potential (Adverse)
- ⊕ Significant Impact Potential (Beneficial)

Impact Category 2:
- \- Unknown or Poorly Defined Impacts (Adverse)
- \+ Unknown or Poorly Defined Impacts (Beneficial)

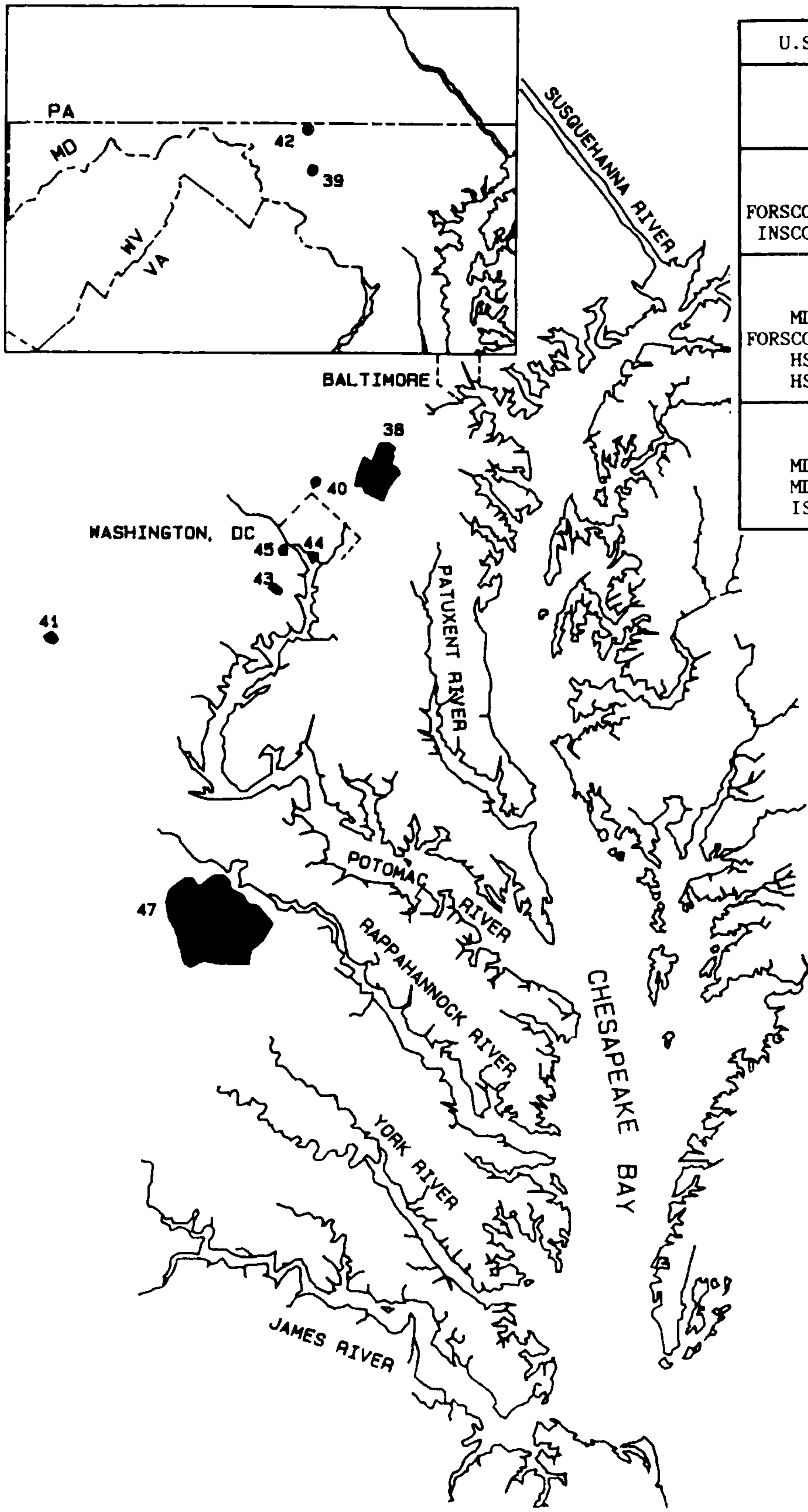
Impact Category 3:
- · Insignificant Impact Potential (Adverse or Beneficial)

located in the Tidal Fresh Potomac region (see Figure 5.7), were judged to represent a likely insignificant potential for water quality impacts by nature of their location and/or activities. Table 5.11 presents the results of the screening for the MDW installations. Although these installations are of little concern environmentally to the Bay, a number of concerns were identified during Phase I of this study. Recommendations to address these areas of concern are given in Section 5.7.

5.6.3.4 Summary of HSC Installation Impacts. The U. S. Army Health Services Command (HSC) is located at Fort Sam Houston, San Antonio, Texas. There are two HSC installations included in this study--Walter Reed Army Medical Center, District of Columbia; and Fort Detrick, Frederick County, Maryland (see Table 5.7). These installations, located above the Fall Line in the Potomac River basin, were judged to represent a likely insignificant potential for water quality impacts by nature of their location and/or activities. Table 5.12 presents the results of the screening for the HSC installations. Although these installations are of little concern environmentally to the Bay, a number of concerns were identified during Phase I of this study. Recommendations to address these areas of concern are given in Section 5.7.

5.6.3.5 Summary of INSCOM Installation Impacts. The U. S. Army Intelligence and Security Command (INSCOM) is located at Arlington Hall Station, Virginia. There is one INSCOM installation included in this study, Vint Hill Farms Station (VHFS), in Fauquier County, Virginia (see Figure 5.7). In Phase III, VHFS was screened in Study Group 2 (poorly defined but likely significant impact potential) (see Table 5.13). Areas of concern at VHFS include cyanide and metals contamination of South Run downstream of the VHFS STP discharge, elevated cyanide contamination in South Run off post and downstream of the former EPA/EPIC photographic laboratory discharge/lagoon, and lack of a permit for land disposal of sludge from the STP. Beneficial activities at VHFS include suspension of a large sandblasting and painting operation, implementation of a pretreatment system at the EPA/EPIC photographic laboratory, and planned installation of a UV system in the STP to eliminate residual chlorine in the effluent. Recommended actions for VHFS are presented in Chapter 4.0 and summarized in Section 5.7.

5.6.3.6 Summary of FORSCOM Installation Impacts. The U.S. Army Forces Command (FORSCOM) is located at Fort McPherson, Georgia. There are two FORSCOM installation included in this study, Fort George G. Meade (FGGM), located in Anne Arundel County, Maryland and Fort A.P. Hill, located near Fredericksburg, Virginia (see Figure 5.7). In Phase III, FGGM was screened in Study Group 2 (see Table 5.13). Areas of concern include: continued problems with pretreatment of NSA's industrial wastewater and subsequent effects on STP operations; potential leachate migration from the existing sanitary landfill; need for erosion and



U.S. ARMY - OTHER INSTALLATIONS	
	<u>STUDY GROUP 1</u>
	(none)
	<u>STUDY GROUP 2</u>
FORSCOM	38 Fort Meade
INSCOM	41 Vint Hill Farms Station
	<u>STUDY GROUP 3</u>
MDW	43 Cameron Station
FORSCOM	47 Fort A.P. Hill
HSC	39 Fort Detrick
HSC	40 Walter Reed Army Med. Ctr.
	<u>STUDY GROUP 4</u>
MDW	44 Fort McNair
MDW	45 Fort Myer
ISC	42 Fort Ritchie

Figure 5.7 Locations of Other U.S. Army Installations in the Chesapeake Bay Region and Summary of Installation Impact Potential.

Table 5.11 Summary of Final Screening for MDW Installations

ON-SITE SCREENING CRITERIA (ON-SITE IMPACT POTENTIAL)

			NON-POINT SOURCES				POINT SOURCES			HAZARDOUS/TOXIC MATERIALS											ENVIRONMENTAL PROGRAMS					
ID	Branch	Installation Name	1. Erosion/Sedimentation	2. Impervious Area Runoff	3. Combined Storm Drains	4. Shoreline Erosion	5. Sewage Treatment	6. Industrial Waste Treat	7. Intermitt Sewage Treat	8. Refueling Operations	9. Munitions Operations	10. Chemical Operations	11. Pesticides	12. Vehicle Maintenance	13. Ship Maintenance	14. Solid Waste Disposal	15. Hazardous Waste	16. SPCC Status	17. Abandoned Sites	18. LUST Status	19. Forestry Mgmt. Plan	20. Wildlife Mgmt. Plan	21. Soil Conservation Plan	22. Stormwater Mgmt. Plan	23. Wetlands Mgmt. Plan	24. Shoreline Erosion Plan
43	ARMY	Cameron Station	·	·	·	·	·	·	·	·	·	·	+	·	·	·	-	+	·	-	·	+	+	+	·	·
44	ARMY	Fort McNair	·	·	·	·	·	·	·	-	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	+
45	ARMY	Fort Myer	·	+	-	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	+	+	·	·

VICINITY SCREENING CRITERIA — RELATIONSHIP TO LOCAL ENVIRONMENT

ID	Branch	Installation Name	25. Shellfish Areas	26. SAV Areas	27. Fish Spawning Areas	28. Wetlands Areas	29. Waterfowl Nesting	30. Endangered Species	31. Relative Local Impact
43	ARMY	Cameron Station	·	·	·	·	+	·	+
44	ARMY	Fort McNair	·	·	·	·	·	·	+
45	ARMY	Fort Myer	·	·	·	·	·	·	·

STUDY GROUP — IMPACT POTENTIAL

ID	Branch	Installation Name	1. Significant	2. Poorly Defined, Sig.	3. Poorly Defined, Insig.	4. Insignificant
43	ARMY	Cameron Station			X	
44	ARMY	Fort McNair				X
45	ARMY	Fort Myer				X
Total Number of Installations per Study Group			0	0	1	2

Score Totals

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
·	3	2	2	3	3	3	3	2	3	3	1	3	3	3	2	1	3	2	3	2	1	1	3	2	3	3	3	3	2	3	1
+	0	1	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	0	1	2	2	0	1	0	0	0	0	1	0	2
⊕	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Θ	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

KEY: Impact Category 1: { Θ Significant Impact Potential (Adverse); ⊕ Significant Impact Potential (Beneficial)

Impact Category 2: { - Unknown or Poorly Defined Impacts (Adverse); + Unknown or Poorly Defined Impacts (Beneficial)

Impact Category 3: · Insignificant Impact Potential (Adverse or Beneficial)

Table 5.12 Summary of Final Screening for HSC Installations

Group	Criterion	40 ARMY Walter Reed Med Ctr.	39 ARMY Fort Detrick	Score Totals ⊖	Score Totals -	Score Totals ⊕	Score Totals +	Score Totals ·
ON-SITE SCREENING CRITERIA (ON-SITE IMPACT POTENTIAL) — NON-POINT SOURCES	1. Erosion/Sedimentation	-	-	-	2	-	-	-
	2. Impervious Area Runoff	+	·	-	-	-	1	1
	3. Combined Storm Drains	·	·	-	-	-	-	2
	4. Shoreline Erosion	·	·	-	-	-	-	2
POINT SOURCES	5. Sewage Treatment	·	⊕	-	-	1	-	1
	6. Industrial Waste Treat	·	·	-	-	-	-	2
	7. Intermitt Sewage Treat	·	+	-	-	-	1	1
HAZARDOUS/TOXIC MATERIALS	8. Refueling Operations	·	·	-	-	-	-	2
	9. Munitions Operations	·	·	-	-	-	-	2
	10. Chemical Operations	·	⊕	-	-	1	-	1
	11. Pesticides	·	+	-	-	-	1	1
	12. Vehicle Maintenance	·	·	-	-	-	-	2
	13. Ship Maintenance	·	·	-	-	-	-	2
	14. Solid Waste Disposal	·	+	-	-	-	1	1
	15. Hazardous Waste	·	·	-	-	-	-	2
	16. SPCC Status	·	-	-	1	-	-	1
	17. Abandoned Sites	-	-	-	2	-	-	-
	18. LUST Status	·	·	-	-	-	-	2
ENVIRONMENTAL PROGRAMS	19. Forestry Mgmt. Plan	·	+	-	-	-	1	1
	20. Wildlife Mgmt. Plan	·	+	-	-	-	1	1
	21. Soil Conservation Plan	+	+	-	-	-	2	-
	22. Stormwater Mgmt. Plan	+	+	-	-	-	2	-
	23. Wetlands Mgmt. Plan	·	·	-	-	-	-	2
	24. Shoreline Erosion Plan	·	·	-	-	-	-	2
VICINITY SCREENING CRITERIA — RELATIONSHIP TO LOCAL ENVIRONMENT	25. Shellfish Areas	·	·	-	-	-	-	2
	26. SAV Areas	·	·	-	-	-	-	2
	27. Fish Spawning Areas	·	·	-	-	-	-	2
	28. Wetlands Areas	·	·	-	-	-	-	2
	29. Waterfowl Nesting	·	·	-	-	-	-	2
	30. Endangered Species	·	·	-	-	-	-	2
	31. Relative Local Impact	·	+	-	-	-	1	1

STUDY GROUP — IMPACT POTENTIAL*	40 ARMY Walter Reed Med Ctr.	39 ARMY Fort Detrick	Total Number of Installations Per Study Group
1. Significant			0
2. Poorly Defined, Sig.			0
3. Poorly Defined, Insig.	X	X	2
4. Insignificant			0

KEY: Impact Category 1: { ⊖ Significant Impact Potential (Adverse); ⊕ Significant Impact Potential (Beneficial)

Impact Category 2: { - Unknown or Poorly Defined Impacts (Adverse); + Unknown or Poorly Defined Impacts (Beneficial)

Impact Category 3: · Insignificant Impact Potential (Adverse or Beneficial)

Table 5.13 Summary of Final Screening for INSCOM, FORSCOM, and ISC Installations

ON-SITE SCREENING CRITERIA (ON-SITE IMPACT POTENTIAL)

			NON-POINT SOURCES				POINT SOURCES		
ID	Branch	Installation Name	1. Erosion/Sedimentation	2. Impervious Area Runoff	3. Combined Storm Drains	4. Shoreline Erosion	5. Sewage Treatment	6. Industrial Waste Treat	7. Intermitt Sewage Treat
42	ARMY	Fort Ritchie (ISC)	⊕	·	·	·	⊕	·	·
38	ARMY	Fort Meade (FORSCOM)	Θ	+	·	·	⊕	-	·
47	ARMY	Ft AP Hill (FORSCOM)	Θ	·	·	·	-	·	-
41	ARMY	Vint Hill FS (INSCOM)	·	·	·	·	Θ	-	·

			HAZARDOUS/TOXIC MATERIALS										
ID	Branch	Installation Name	8. Refueling Operations	9. Munitions Operations	10. Chemical Operations	11. Pesticides	12. Vehicle Maintenance	13. Ship Maintenance	14. Solid Waste Disposal	15. Hazardous Waste	16. SPCC Status	17. Abandoned Sites	18. LUST Status
42	ARMY	Fort Ritchie (ISC)	·	·	·	⊕	·	·	·	+	+	·	·
38	ARMY	Fort Meade (FORSCOM)	+	+	+	⊕	+	·	+	-	+	Θ	-
47	ARMY	Ft AP Hill (FORSCOM)	-	-	·	+	·	·	+	-	-	Θ	-
41	ARMY	Vint Hill FS (INSCOM)	·	·	·	·	⊕	·	Θ	+	-	Θ	-

			ENVIRONMENTAL PROGRAMS					
ID	Branch	Installation Name	19. Forestry Mgmt. Plan	20. Wildlife Mgmt. Plan	21. Soil Conservation Plan	22. Stormwater Mgmt. Plan	23. Wetlands Mgmt. Plan	24. Shoreline Erosion Plan
42	ARMY	Fort Ritchie (ISC)	+	+	⊕	⊕	·	·
38	ARMY	Fort Meade (FORSCOM)	⊕	⊕	+	+	⊕	·
47	ARMY	Ft AP Hill (FORSCOM)	Θ	⊕	Θ	·	+	·
41	ARMY	Vint Hill FS (INSCOM)	+	·	+	+	·	·

VICINITY SCREENING CRITERIA

			RELATIONSHIP TO LOCAL ENVIRONMENT						
ID	Branch	Installation Name	25. Shellfish Areas	26. SAV Areas	27. Fish Spawning Areas	28. Wetlands Areas	29. Waterfowl Nesting	30. Endangered Species	31. Relative Local Impact
42	ARMY	Fort Ritchie (ISC)	·	·	·	·	⊕	·	·
38	ARMY	Fort Meade (FORSCOM)	·	·	·	⊕	⊕	+	-
47	ARMY	Ft AP Hill (FORSCOM)	·	·	-	-	⊕	-	·
41	ARMY	Vint Hill FS (INSCOM)	·	·	·	·	·	·	-

STUDY GROUP

			IMPACT POTENTIAL*			
ID	Branch	Installation Name	1. Significant	2. Poorly Defined, Sig.	3. Poorly Defined, Insig.	4. Insignificant
42	ARMY	Fort Ritchie (ISC)				X
38	ARMY	Fort Meade (FORSCOM)		X		
47	ARMY	Ft AP Hill (FORSCOM)			X	
41	ARMY	Vint Hill FS (INSCOM)		X		

KEY:

Impact Category 1:
- Θ Significant Impact Potential (Adverse)
- ⊕ Significant Impact Potential (Beneficial)

Impact Category 2:
- \- Unknown or Poorly Defined Impacts (Adverse)
- \+ Unknown or Poorly Defined Impacts (Beneficial)

Impact Category 3:
- · Insignificant Impact Potential (Adverse or Beneficial)

sedimentation controls; and questionable hazardous waste disposal practices. Beneficial practices at FGGM include: implementation of progressive land management and natural resources plans: upgrading of the sewage treatment system; and recycling of waste POL. Fort A. P. Hill, originally judged to represent a poorly defined but likely significant impact potential during Phase I, was reassessed during Phase III and assigned to the category of "poorly defined but likely insignificant impact potential." Available information for Fort A. P. Hill indicates that the problems of sewage treatment, surface erosion, and past chemical/toxics spills have been largely confined to the base or, in the latter case, have been adequately cleaned up and controlled. Recommended actions for FGGM and A.P. Hill are presented in Chapter 4.0 and summarized in Section 5.7.

5.6.3.7 Summary of ISC Installation Impacts. The U. S. Army Information Systems Command (ISC) is located at Fort Huachuca, Arizona. There is one ISC installation included in this study, Fort Ritchie, located in Washington County, Maryland (see Figure 5.7). In Phase I, Fort Ritchie was screened in Study Group 4 (insignificant impact potential) (see Table 5.13). Fort Ritchie has many positive attributes, including an effective soil conservation and stormwater management program, and a natural resources program. There are no recommended actions for this installation.

5.6.4 U.S. Air Force Installations

There are a total of six USAF installations included in this study. These represent 9% of the DoD installations operating in the Chesapeake drainage area. Figure 5.8 shows the approximate locations of the USAF installations relative to the Chesapeake Bay, and lists these installations by study code number and by Study Group.

Of the six USAF installations, three (Bolling AFB, Brandywine DRMO, and Davidsonville RDV), were estimated during Phase I of this study to represent an insignificant potential for water quality impacts. The remaining three (Andrews AFB, Brandywine RDV, and Langley AFB) were estimated to represent a significant potential for water quality impacts by nature of their activities, and were examined in greater detail during Phases II and III of this study. Presented below is a brief summary of the findings for these USAF installations.

Table 5.14 presents the results of the final screening of all six USAF installations. None of the USAF installations were screened in the category of significant adverse impacts. Two of the six installations, Andrews AFB and Langley AFB, were judged to represent a poorly defined but likely significant impact potential to local water quality and biological resources. Primary concerns include: stormwater runoff carrying contaminants from large impervious surfaces (runways); unknown effectiveness and/or need for oil/water separation in storm drainage systems; and potential for contaminant migration to surface waters from

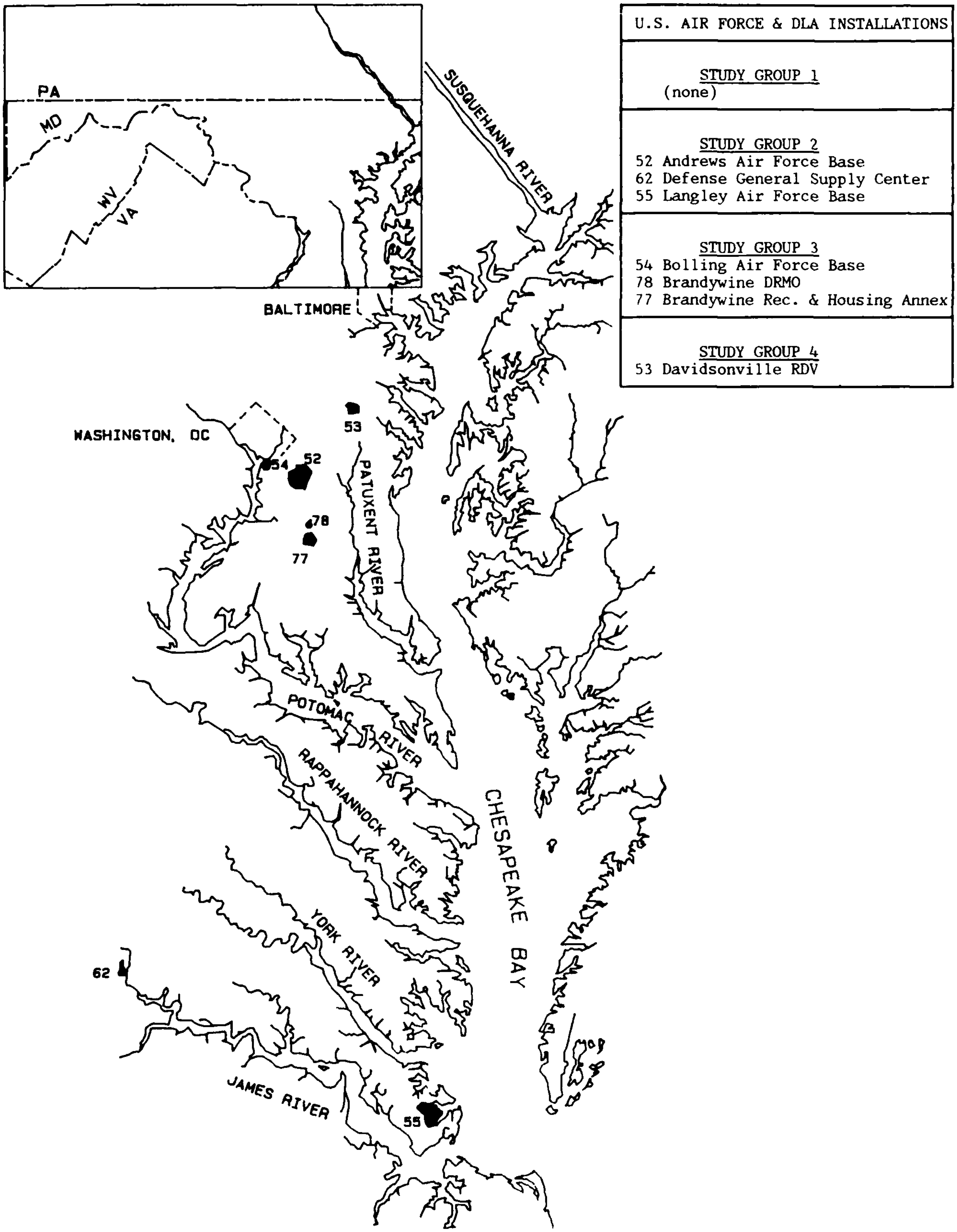


Figure 5.8 Locations of U.S. Air Force and DLA Installations in the Chesapeake Bay Region and Summary of Installation Impact Potential.

Table 5.14 Summary of Final Screening for U.S. Air Force Installations

ON-SITE SCREENING CRITERIA (ON-SITE IMPACT POTENTIAL)

ID	Branch	Installation Name	NON-POINT SOURCES: 1. Erosion/Sedimentation	2. Impervious Area Runoff	3. Combined Storm Drains	4. Shoreline Erosion	POINT SOURCES: 5. Sewage Treatment	6. Industrial Waste Treat	7. Intermitt Sewage Treat	HAZARDOUS/TOXIC MATERIALS: 8. Refueling Operations	9. Munitions Operations	10. Chemical Operations	11. Pesticides	12. Vehicle Maintenance
52	USAF	Andrews AFB	-	-	+	·	·	·	·	-	·	·	+	-
54	USAF	Bolling AFB	·	-	·	·	·	·	·	-	·	·	+	·
78	DLA	Brandywine DRMO	·	·	·	·	·	·	Θ	·	·	·	·	·
77	USAF	Brandywine RHA	·	·	·	·	·	·	+	·	·	·	·	·
53	USAF	Davidsonville RDV	·	·	·	·	·	·	·	·	·	·	·	·
55	USAF	Langley AFB	+	-	·	+	·	·	-	-	·	·	⊕	-
		Score Totals ·	4	3	5	5	6	6	3	3	6	6	3	4
		Score Totals +	1	0	1	1	0	0	1	0	0	0	2	0
		Score Totals ⊕	0	0	0	0	0	0	0	0	0	0	1	0
		Score Totals -	1	3	0	0	0	0	1	3	0	0	0	2
		Score Totals Θ	0	0	0	0	0	0	1	0	0	0	0	0

ID	Branch	Installation Name	HAZARDOUS/TOXIC MATERIALS: 13. Ship Maintenance	14. Solid Waste Disposal	15. Hazardous Waste	16. SPCC Status	17. Abandoned Sites	18. LUST Status	ENVIRONMENTAL PROGRAMS: 19. Forestry Mgmt. Plan	20. Wildlife Mgmt. Plan	21. Soil Conservation Plan	22. Stormwater Mgmt. Plan	23. Wetlands Mgmt. Plan	24. Shoreline Erosion Plan
52	USAF	Andrews AFB	·	·	-	-	-	-	·	·	-	+	·	·
54	USAF	Bolling AFB	·	·	·	-	-	-	·	·	·	-	·	+
78	DLA	Brandywine DRMO	·	·	-	Θ	-	·	·	·	·	·	·	·
77	USAF	Brandywine RHA	·	·	·	-	Θ	·	·	·	·	·	·	·
53	USAF	Davidsonville RDV	·	-	·	·	·	+	·	·	·	·	-	·
55	USAF	Langley AFB	·	·	·	+	-	-	+	·	+	-	·	+
		Score Totals ·	6	5	4	1	1	2	5	6	4	3	5	4
		Score Totals +	0	0	0	1	0	1	1	0	1	1	0	2
		Score Totals ⊕	0	0	0	0	0	0	0	0	0	0	0	0
		Score Totals -	0	1	2	3	4	3	0	0	1	2	1	0
		Score Totals Θ	0	0	0	1	1	0	0	0	0	0	0	0

VICINITY SCREENING CRITERIA / STUDY GROUP

ID	Branch	Installation Name	RELATIONSHIP TO LOCAL ENVIRONMENT: 25. Shellfish Areas	26. SAV Areas	27. Fish Spawning Areas	28. Wetlands Areas	29. Waterfowl Nesting	30. Endangered Species	31. Relative Local Impact	IMPACT POTENTIAL: 1. Significant	2. Poorly Defined, Sig.	3. Poorly Defined, Insig.	4. Insignificant
52	USAF	Andrews AFB	·	·	-	·	·	·	-		X		
54	USAF	Bolling AFB	·	+	·	·	·	·	-			X	
78	DLA	Brandywine DRMO	·	·	·	·	·	·	·			X	
77	USAF	Brandywine RHA	·	·	·	·	·	·	+			X	
53	USAF	Davidsonville RDV	·	·	+	+	·	·	+				X
55	USAF	Langley AFB	-	·	·	+	+	·	-		X		
		Total Number of Installations per Study Group								0	2	3	1
		Score Totals ·	5	5	4	4	5	6	1				
		Score Totals +	0	1	1	2	1	0	2				
		Score Totals ⊕	0	0	0	0	0	0	0				
		Score Totals -	1	0	1	0	0	0	3				
		Score Totals Θ	0	0	0	0	0	0	0				

KEY: Impact Category 1: { Θ Significant Impact Potential (Adverse)
⊕ Significant Impact Potential (Beneficial)

Impact Category 2: { - Unknown or Poorly Defined Impacts (Adverse)
\+ Unknown or Poorly Defined Impacts (Beneficial)

Impact Category 3: · Insignificant Impact Potential (Adverse or Beneficial)

poorly characterized inactive waste disposal sites. Brandywine RDV, originally estimated to represent a poorly defined but likely significant impact potential during Phase I, was reassessed during Phase III and assigned to the category of "poorly defined but likely insignificant impact potential." Available information for Brandywine RDV appears to indicate that the impact level on the receiving stream from fuel spills is low and will probably decrease since: 1) the source of POL contamination is relative small; and 2) cleanup actions are planned.

The remaining three USAF installations, including Bolling AFB, Brandywine DRMO, and Davidsonville RDV, were estimated to represent a likely insignificant potential for water quality impacts, based on the available information.

The region of influence of the USAF installations appears to be limited to the immediate vicinity of each installation. Compared to the surrounding point and nonpoint sources, the USAF installations contribute an insignificant loading of conventional pollutants (BOD, nutrients, sediments) to the Chesapeake Bay. The most beneficial programs at the USAF installations for pollution control and environmental enhancement have included preservation of land in an undeveloped state, tightly controlled pesticides management, and self-monitoring of water quality in the drainage pathways to determine the need for upgrade(s) or additions to oil/water separators (Langley and Andrews Air Force Bases).

Ongoing areas of concern at the USAF installations relate primarily to activities that are difficult to control or regulate. They include control and treatment of stormwater runoff, prevention and control of fuel spills, and potential migration of contaminants into surface waters from inactive hazardous waste disposal and spill sites. A number of recommendations have been developed to address these and other areas and are presented in Chapter 4.0 and summarized in Section 5.7.

5.6.5 Summary of Defense Logistics Agency (DLA) Installation Impacts

There is one DLA installation included in this study, Defense General Supply Center (DGSC), located near Richmond, Virginia (see Figure 5.8). In Phase III, DGSC was screened in Study Group 2 (poorly defined, likely significant impact potential) (see Table 5.1). Areas of concern include: the potential migration of contaminants to receiving waters from the former Fire Training Area, the former Area 50 landfill, and the Open Storage Area; as well as questionable quality of stormwater runoff from large impervious surfaces. Recommended actions for DGSC are presented in Chapter 4.0 and summarized in Section 5.7.

5.7 SUMMARY OF RECOMMENDED DOD STUDIES/PRACTICES OR PROJECTS

An important goal of this project is to develop recommendations for additional studies, practices or projects that could be implemented at specific DoD installations, where necessary, to restore and protect water quality and living resources of the Chesapeake Bay. These recommended actions are presented for each installation in Chapter 4.0 of this report. Also, table 5.15 summarizes the recommended actions by screening criteria. The installation-specific recommendations presented in Chapter 4.0 are combined under the more generic areas presented in Table 5.15. It is recalled from Tables 5.4 through 5.6 that the screening criteria were ranked according to the frequency of occurrence of concerns under each criterion. This ranking level, also indicated in Table 5.15, can be used to help prioritize the recommendations according to greatest frequency and relative importance for protection of the Bay's aquatic resources. As observed in this table for point sources, nonpoint sources, and hazardous/toxic materials (criteria 1 through 18) the most frequently occurring recommendations relate to abandoned waste disposal sites, impervious area runoff, erosion/siltation, underground storage tank (UST) status, combined storm drains, and industrial waste treatment. For environmental programs (criteria 19 through 24), the most frequently occurring recommendations include development of stormwater management plans, soil conservation plans, and wetlands management plans.

Included in Table 5.15, for each generic recommendation, are an approximate cost range, a qualitative description of the benefits associated with implementing the recommended action, and a list of installations for which the generic recommendation was identified. It is emphasized that the cost estimates are very approximate (order of magnitude). These costs are based on available information from both DoD and non-DoD sources for projects similar in scope to those presented here. Also, the description of benefits to water quality are highly generalized. Even for a specific receiving water body at a specific installation, the quantification of benefits in terms of the increased value of biological resources or recreational use is difficult and arbitrary. More detailed information on each installation-specific recommendation can be obtained by reviewing the appropriate section in Chapter 4.0 of this report.

Finally, as a visual aid in interpreting these generic recommendations, Figures 5.9 through 5.18 have been prepared. These figures present the locations of installations which received recommendations under the top ten ranked criteria for point sources, nonpoint sources, and hazardous/toxic materials. These figures can be used in conjunction with Table 5.15 to locate installations listed under each generic recommendation.

Table 5.15 Summary of Generic Recommendations and Their Estimated Costs and Potential Benefits to Surface Water Quality

SCREENING CRITERIA	GENERIC RECOMMENDATIONS	ESTIMATED COST	INSTALLATIONS INVOLVED	POTENTIAL BENEFITS TO SURFACE WATER QUALITY
1. Erosion/ Sedimentation Pollutant of concern: Total Suspended Solids (TSS)	a. Control soil erosion in and around landfill sites	For 10 acre site: \$40,000 (erosion control only) to \$400,000 (clay cap, cover, erosion and leachate control)	7,8 NAS/NATC Patuxent 40 Walter Reed Med. Ctr. 80 HDL - Blossom Point	Reduction in suspended solids increases light penetration, reduce clogging of gills, enhance spawning habitats, reduces smothering of benthic organisms/plants, and reduces transport of heavy metals/organics sorbed to sediment.
	b. Implement erosion controls for stormwater runoff using BMPs	Sediment basins: < 50 acres \$5,000 > 50 acres \$10,000 + Stormwater Conveyance Channel: riprap lined \$50/yd^2 concrete \$80/yd^2 Check dams (rock): \$30/yd^3 Drop Structure: \$120/yd^3 Streambank Protection: nongrouted riprap \$45/yd^2 grouted riprap \$60/yd^2 gabions \$90/yd^3 log cribbing \$90/yd^3	15 Naval Air Sta-Oceana 30 Allegany Ballis. Lab 36 Letterkenny Army Dep. 48 Fort Belvoir 47 Fort A. P. Hill 38 Fort Meade 29 NAVRADSTA - Sugar Grove 39 Fort Detrick 1 USMC - Quantico 52 Andrews AFB 80 HDL - Blossom Point	Same as above (see also Appendix C) Volume 2

Table 5.15 Summary of Generic Recommendations and Their Estimated Costs and Potential Benefits to Surface Water Quality (Continued)

SCREENING CRITERIA	GENERIC RECOMMENDATIONS	ESTIMATED COST	INSTALLATIONS INVOLVED	POTENTIAL BENEFITS TO SURFACE WATER QUALITY
2. Impervious Area Runoff Pollutants of Concern: Oil and Grease, heavy metals, hydrocarbons, TSS	a. Oil/water separators are needed to intercept impervious area runoff prior to reaching surface waters	<u>To construct one separator</u>: $5,000 to $20,000	4 NSWC - White Oak 52 Andrews AFB 55 Langley AFB 32 Wash. Naval Yard 33 Naval Research Lab 7,8 NAS/NATC Patuxent	Reduction of oil and grease and hydrocarbons reduces long-term sublethal effects on cellular and physiological processes such as feeding and reproduction. Reduction of toxic organics or heavy metals residuals reduces risk of histopathological abnormalities, metabolic and fecundity suppression, simplification of trophic levels, increase in pollutant tolerant species, and unsuitable spawning and living conditions. (see also Appendix C)
	b. Upgrade oil/water separators to handle high flow (wet) conditions, high tide conditions	<u>To upgrade one separator</u>: $5,000 to $20,000	22 Naval Sup. Ctr. - Craney 15 Naval Air Sta. - Oceana 65 Navy SPCC 49 Fort Eustis 52 Andrews AFB 62 Defense Gen. Sup. Ctr. 54 Bolling AFB	
	c. Institute surface water monitoring program to determine if contaminants are present and whether there is a need for controls	<u>To design program</u> (See Appendix A Volume 2): $20,000 <u>To monitor seasonally</u>: $25,000/yr - "small" installation (approx. 5 stations, conventionals, metals) $100,000/yr - "large" installation (approx. 20 stations conventionals, metals) NOTE: Double or triple above costs to include priority pollutants	65 Navy SPCC 48 Fort Belvoir 47 Fort A. P. Hill 49 Fort Eustis 55 Langley AFB 62 Defense Gen. Sup. Ctr. 12 Naval Med. Com. - NCR 40 Walter Reed Med. Ctr. 7,8 NAS/NATC Patuxent 4 NSWC - White Oak 14 David Taylor - Annapolis 17 Sewells Pt. Naval Cmpx. 52 Andrews AFB	

Table 5.15 Summary of Generic Recommendations and Their Estimated Costs and Potential Benefits to Surface Water Quality (Continued)

SCREENING CRITERIA	GENERIC RECOMMENDATIONS	ESTIMATED COST	INSTALLATIONS INVOLVED	POTENTIAL BENEFITS TO SURFACE WATER QUALITY
3. Combined Storm Drains Pollutants of Concern: Toxics (primary); BOD/nutrients/TSS/ low pH/Oil & Grease (secondary)	a. Connect combined storm drain discharge into local or installation sanitary sewer system for treatment by STP	<u>For one drain</u>: $30,000 to $150,000 (depending on gravity or pumped system)	10 U.S. Naval Academy 48 Fort Belvoir 12 Naval Med. Com. - NCR 17 Sewells Pt. Naval Cmpx.	Reduction of toxic organics or heavy metals residuals reduces risk of histopathological abnormalities, metabolic and fecundity suppression, simplification of trophic levels, increase in pollutant tolerant species, and unsuitable spawning and living conditions. Reduction in nutrients decreases likelihood of eutrophication conditions (biological nuisances). Reduction in BOD reduces deoxygenation by decaying organic material, resulting in higher dissolved oxygen levels for aquatic biota. Avoidance of low pH reduces toxicity levels of certain compounds in solution, and reduce direct physiological stress to aquatic biota.
	b. Monitor effluent during dry and wet weather to determine need for separators, or other controls	<u>Per station per year</u>: $5,000 - conventionals only $25,000 -conventionals, metals, priority pollutants NOTE: Typical monitoring program would include from 4 to 20 station	14 David Taylor - Annapolis 4 NSWC - White Oak 1 USMC - Quantico 17 Sewells Pt. Naval Cmpx. 36 Letterkenny Army Dep. 48 Fort Belvoir	

Table 5.15 Summary of Generic Recommendations and Their Estimated Costs and Potential Benefits to Surface Water Quality (Continued)

SCREENING CRITERIA	GENERIC RECOMMENDATIONS	ESTIMATED COST	INSTALLATIONS INVOLVED	POTENTIAL BENEFITS TO SURFACE WATER QUALITY
4. Shoreline Erosion Pollutants of Concern: TSS, heavy metals	a. Implement bluff/shoreline erosion control measures where on-site facilities are threatened	Low energy zone: (vol. loss < 1yd^3/ft/yr) \$25/ft bank treatment \$125/ft revetment or \$100/ft vegetative planting Moderate energy zone: (1 < vol. loss < 2) yd^3/ft/yr \$25/ft bank treatment \$125/ft revetment or \$175/ft gabion breakwater High energy zone: (vol. loss > 2yd^3/ft/yr) \$25/ft bank treatment \$375/ft revetment or \$350/ft offshore breakwater or \$300/ft bulkhead timber Notes: 1) Other shore protection alternatives exist 2) Selection of type and cost is highly dependent on local conditions, wave exposure, access, geotechnical conditions and degree of protection needed. 3) Bank treatment includes removal of exposed trees and reduction of slope grade.	3 Naval Station - Annap. 7,8 NAS/NATC - Patuxent 5 NOS - Indian Head 27 Naval Sup. Ctr.-Cht.Anx. 80 HDL - Blossom Point 9 Naval Res. Lab. - CBD 6 Naval Air Sta. - Sol Anx 11 Naval Elect. Sys. Eng. 28 Camp Peary 51 Fort Story	Reduction in suspended solids increases light penetration, reduces clogging of gills, enhances spawning habitats, reduces smothering of benthic organisms/plants, and reduces transport of heavy metals/organics sorbed to sediment.

Table 5.15 Summary of Generic Recommendations and Their Estimated Costs and Potential Benefits to Surface Water Quality (Continued)

SCREENING CRITERIA	GENERIC RECOMMENDATIONS	ESTIMATED COST	INSTALLATIONS INVOLVED	POTENTIAL BENEFITS TO SURFACE WATER QUALITY
5. Sewage Treatment Pollutants of Concern: BOD, TSS, Nutrients, Chlorine	a. Correct design and/or operation inadequacies to improve plant effluent quality	<u>Flow equalization tank</u>: $175,000 (small system) (controls BOD/TSS) <u>Holding Ponds</u>: $80,000 (small system) <u>Develop Procedures Manual</u>: $25,000 - $50,000 NOTE: Small system <20,000 GPD	3 Naval Station - Annap. 1 USMC - Quantico 2 NSWC - Dahlgren 30 Allegany Ballist. Lab 34 Aberdeen Proving Ground 47 Fort A. P. Hill 41 Vint Hill Farms Sta.	Reduction in BOD will reduce deoxygenation by decaying organic material, resulting in higher dissolved oxygen levels for aquatic biota. Reduction in nutrients decreases likelihood of eutrophication conditions (biological nuisances).
	b. Eliminate chlorine residual from STP discharge	<u>Corrections to System</u>: $25,000 (small system) $100,000 (large system) NOTE: Large system >100,000 GPD	5 NOS - Indian Head 2 NSWC - Dahlgren 34 Aberdeen Proving Ground	The State of Maryland has a zero chlorine discharge requirement. Reduction in residual chlorine reduces generation of chlorine complexes which are toxic to aquatic life and result in physiological stress and avoidance behavior.
	c. Upgrade deteriorated sewage collection system	<u>Upgrade to new system</u>: $25,000 to $2,000,000	85 Naval Com. Unit 50 Fort Monroe 45 Fort Myer	Deteriorated sewage collection system is susceptible to leaks which may contaminate ground water supply and/or reach surface waters.

Tal 5.15 Summary of Generic Recommendations and Their Estimated Costs and Potential Benefits to Surface Water Quality (Continued)

SCREENING CRITERIA	GENERIC RECOMMENDATIONS	ESTIMATED COST	INSTALLATIONS INVOLVED	POTENTIAL BENEFITS TO SURFACE WATER QUALITY
6. Industrial Waste Treatment Pollutants of Concern: TSS, BOD, Nutrients, heavy metals, phenols, trace organics, H_2S, pH	a. Obtain NPDES permit and/or monitor discharge as required by NPDES permit (permit may require pre-treatment or plant process upgrades)	Monitoring Cost (per outfall): $5,000 to $20,000 per year $5,000 - quarterly for conventionals and metals $20,000 - monthly for conventionals and metals. Quarterly for priority pollutants	14 David Taylor - Annap. 5 NOS - Indian Head 83 Naval Sup Ctr - Yorktown 36 Letterkenny Army Dep.	Reduction of toxic organics or heavy metals residuals reduces risk of histopathological abnormalities, metabolic and fecundity suppression, simplification of trophic levels, increase in pollutant tolerant species, and unsuitable spawning and living conditions.
	b. Install/service/upgrade oil/water separator(s) to intercept effluent	$5,000 to $20,000	4 NSWC - White Oak 49 Fort Eustis	
	c. Install/upgrade (as necessary) pre-treatment system prior to discharge of effluent	Typical Examples: Sludge dewatering, metals removal- $65,000 Medical waste incinerator - $225,000 Pathological incinerator - $75,000 Plating shop - $125,000 Paint stripping-$15,000 PNC facility - $135,000 HBNQ - $55,000 Motor cleanout -$10,000 Paint booth - $10,000 Sulfate removal - $1,000,000	5 NOS - Indian Head 2 NSWC - Dahlgren 23 Naval Shipyard - Norfolk 34 Aberdeen Proving Ground 41 Vint Hill Farms Sta. 33 Naval Research Lab	reduces toxicity of certain compounds in solution, and reduce direct physiological stress to aquatic biota. Reduction in sulfates reduces risk of H_2S production in anaerobic waters, which would reduce stressful conditions to aquatic biota. Reduction in nutrients decreases likelihood of eutrophication conditions (biological nuisances). Reduction in BOD reduces deoxygenation by decaying organic material, resulting in higher dissolved oxygen levels for aquatic biota.

Table 5.15 Summary of Generic Recommendations and Their Estimated Costs and Potential Benefits to Surface Water Quality (Continued)

SCREENING CRITERIA	GENERIC RECOMMENDATIONS	ESTIMATED COST	INSTALLATIONS INVOLVED	POTENTIAL BENEFITS TO SURFACE WATER QUALITY
6. Industrial Waste Treatment (continued) Pollutants of Concern: TSS, BOD, Nutrients, heavy metals, phenols, trace organics, H_2S, pH	d. Review pretreatment process and operations to improve effluent quality	<u>Process Review/ Assessment</u>: \$ 20,000 to \$200,000 NOTE: Cost dependent on process type and size	2 NSWC - Dahlgren[1] 26 NWS - Yorktown[2] 17 Sewells Pt Navy Cmpx[3,5] 23 Naval Shipyard - Norfolk 36 Letterkenny Army Dep[6] 38 Fort Meade[3] 5 NOS Indian Head[1] 49 Fort Eustis[7]	Same as above.
	e. Implement Effluent Toxics Monitoring Program	<u>Design Program</u>: \$20,000 - \$50,000 <u>Monitor</u>: \$10,000 - \$30,000 per year per outfall	5 NOS Indian Head 2 NSWC Dahlgren 23 Naval Shipyard - Norfolk 34 Aberdeen Proving Ground 41 Vint Hill Farms Sta.	

1 TSS, BOD, Nutrients
2 Explosives
3 Metals
4 PAHs
5 Phenols
6 H_2S
7 Trace Organics

Table 5.15 Summary of Generic Recommendations and Their Estimated Costs and Potential Benefits to Surface Water Quality (Continued)

SCREENING CRITERIA	GENERIC RECOMMENDATIONS	ESTIMATED COST	INSTALLATIONS INVOLVED	POTENTIAL BENEFITS TO SURFACE WATER QUALITY
7. Intermittent or Remote Sewage Treatment Pollutants of Concern: BOD, nutrients, coliforms	a. Connect septic systems to existing sanitary sewer lines for treatment at STP	Connection Costs: $50,000 to $100,000 (each system)	4 NSWC - White Oak 65 Navy SPCC 3 Naval Station - Annap.	Reduction in BOD reduces deoxygenation by decaying organic material resulting in higher dissolved oxygen levels for aquatic biota. Reduction in nutrients decreases likelihood of eutrophication conditions (biological nuisances). Reduction in coliform bacteria may be necessary to meet State/Federal water quality criteria.
	b. Check, clean and replace/relocate septic systems as required after inspection.	$20,000 - $40,000	80 HDL - Blossom Point 78 Brandywine DRMO	
	c. Provide for seasonal treatment of "grey water" at remote campsites	Small Package STP: $500,000 - 0.5 MGD $40,000/year O & M	47 Fort A. P. Hill	

Table 5.15 Summary of Generic Recommendations and Their Estimated Costs and Potential Benefits to Surface Water Quality (Continued)

SCREENING CRITERIA	GENERIC RECOMMENDATIONS	ESTIMATED COST	INSTALLATIONS INVOLVED	POTENTIAL BENEFITS TO SURFACE WATER QUALITY
8. Refueling Operations Pollutants of Concern: petroleum hydrocarbons, fuels, oil and grease	a. Provide secondary containment and spill protection measures as required	$10,000 to $1,500,000 (depends on measures required and size of facility) examples: containment pad for sulvents, chemicals with drains and holding tanks - $200,000 Berm around fuel storage area - $10,000 Oil/water Separator- $5,000 - $20,000 Oil Spill Prevention facilities: wash racks, oil/water separator, treatment system for drainage - $1,500,000	83 NSC - Yorktown 55 Langley AFB 62 Defense Gen. Sup. Ctr. 44 Fort McNair 52 Andrews AFB	Reduction of oil and grease and hydrocarbons reduces long-term sublethal effects on cellular and physiological processes such as feeding and reproduction. Prevention of large oil spills prevents short-term acute lethal effects on aquatic life forms, and drowning of waterfowl.

Table 5.15 Summary of Generic Recommendations and Their Estimated Costs and Potential Benefits to Surface Water Quality (Continued)

SCREENING CRITERIA	GENERIC RECOMMENDATIONS	ESTIMATED COST	INSTALLATIONS INVOLVED	POTENTIAL BENEFITS TO SURFACE WATER QUALITY
9. Munitions Operations Pollutants of Concern: Ordnance, toxics, propellants, chemical agents	a. Cease ordnance impacts in wetlands or rivers/bay. Construct man-made water impact areas if necessary	Unknown	80 HDL - Blossom Point 34 Aberdeen Proving Ground 2 NSWC - Dahlgren	Reduce impact of physical stress from shock waves and chemical stress from ordnance chemicals (organics and heavy metals). Reduce destruction of valuable wetland habitat.
	b. Monitor stormwater runoff from munitions testing or detonation areas	<u>Develop Program</u>: $ 15,000 - $40,000 <u>Monitoring Cost</u>: $ 25,000 -"small" site 2-3 sampling stations $100,000 -"large" site 10-15 sampling stations (cost per site - one time event, seasonal sampling, metals and priority pollutants)	34 Aberdeen Proving Ground	Reduction of toxic organics or heavy metals residuals reduces risk of histopathological abnormalities, metabolic and fecundity suppression, simplification of trophic levels, increase in pollutant tolerant species, and unsuitable spawning and living conditions.

Table 5.15 Summary of Generic Recommendations and Their Estimated Costs and Potential Benefits to Surface Water Quality (Continued)

SCREENING CRITERIA	GENERIC RECOMMENDATIONS	ESTIMATED COST	INSTALLATIONS INVOLVED	POTENTIAL BENEFITS TO SURFACE WATER QUALITY
10. Chemical Operations Pollutants of Concern: Trace organics, exotic chemical agents, propellant chemicals, heavy metals	a. Establish monitoring program to confirm/deny migration of pollutants from laboratory and/or testing area	Develop Program: $25,000 Monitoring Cost: $25,000 -"small" site 2-3 sampling stations $100,000 -"large" site 10-15 sampling stations (cost per site - one time event, seasonal sampling metals, priority pollutants, chemical agents)	30 Allegany Ballist. Lab 34 Aberdeen Proving Ground	Reduction of toxic organics or heavy metals residuals reduces risk of histopathological abnormalities, metabolic and fecundity suppression, simplification of trophic levels, increase in pollutant tolerant species, and unsuitable spawning and living conditions.
	b. Add burnpad/detonation areas to confirmation sites list	Confirmation Monitoring: $25,000 to $50,000 (per site - one time event)	34 Aberdeen Proving Ground 80 HDL Blossom Point	

Table 5.15 Summary of Generic Recommendations and Their Estimated Costs and Potential Benefits to Surface Water Quality (Continued)

SCREENING CRITERIA	GENERIC RECOMMENDATIONS	ESTIMATED COST	INSTALLATIONS INVOLVED	POTENTIAL BENEFITS TO SURFACE WATER QUALITY
11. Pesticides Pollutants of Concern: Pesticides, biocides	a. Monitor use of pesticides in agricultural outleases especially in surface water drainage paths	Labor cost to properly manage/audit and ensure compliance with BMPs: $25,000 to $50,000/year (1/2 to 1 man year)	36 Letterkenny Army Dep.	Reduction in pesticides/biocides levels in runoff reduces risk of mutagenicity for aquatic biota, destruction of aquatic plants.
	b. Practice strict management of biocide/herbicide applications on site	Labor cost for proper management of biocides applications: $25,000 to $50,000/year (1/2 to 1 man year)	47 Fort A. P. Hill	Same as above.

Table 5.15 Summary of Generic Recommendations and Their Estimated Costs and Potential Benefits to Surface Water Quality (Continued)

SCREENING CRITERIA	GENERIC RECOMMENDATIONS	ESTIMATED COST	INSTALLATIONS INVOLVED	POTENTIAL BENEFITS TO SURFACE WATER QUALITY
12. Vehicle Maintenance	No recommendations			
13. Ship Maintenance Pollutants of Concern: sandblast contaminants, heavy metals, oil and grease, fuels	a. Review operation of ship maintenance with respect to BMPs to control the release of: 1) oil/fuel, graywater, sewage 2) sandblast grit, lead, organotin	<u>Assessment Study</u>: $50,000 to $100,000 <u>Example Corrective Measures</u>: Sandblast grit reclamation unit - $350,000 Vacuum system - $75,000 Oil/water separator - $20,000	3 Naval Station - Annap. 17 Sewells Pt. Naval Cmpx 16 NAB - Little Creek 23 Naval Shipyard - Norfolk	Reduction of oil and grease and hydrocarbons reduces long-term sublethal effects on cellular and physiological processes such as feeding and reproduction. Reduction of toxic organics or heavy metals residuals reduces risk of histopathological abnormalities, metabolic and fecundity suppression, simplification of trophic levels, increase in pollutant tolerant species, and unsuitable spawning and living conditions.

Table 5.15 Summary of Generic Recommendations and Their Estimated Costs and Potential Benefits to Surface Water Quality (Continued)

SCREENING CRITERIA	GENERIC RECOMMENDATIONS	ESTIMATED COST	INSTALLATIONS INVOLVED	POTENTIAL BENEFITS TO SURFACE WATER QUALITY
14. Solid Waste Disposal Pollutants of Concern: Trace organics, heavy metals, BOD, low pH	a. Monitor leachate from active landfill	Monitoring Cost: $25,000 to $75,000/year Dependent on number of sampling stations and constituents sampled (see Appendix A, Volume 2)	48 Fort Belvoir 38 Fort Meade 49 Fort Eustis	Reduction of toxic organics or heavy metals residuals reduces risk of histopathological abnormalities, metabolic and fecundity suppression, simplification of trophic levels, increase in pollutant tolerant species,
	b. Install BMP's to stop migration of contaminants from active landfill	Cost to repair, reline, regrade active landfill $250,000 - average Cost to grade, cap, cover, vegetate, provide erosion/leachate control for 10 acre inactive landfill: $400,000 and up Cost for sludge lagoon liner: $150,000	38 Fort Meade 49 Fort Eustis	and unsuitable spawning and living conditions. Reduction in BOD reduces deoxygenation by decaying organic material resulting in higher dissolved oxygen levels for aquatic biota. Avoidance of low pH reduce toxicity of certain compounds in solution, and reduce direct physiological stress to aquatic biota.

Table 5.15 Summary of Generic Recommendations and Their Estimated Costs and Potential Benefits to Surface Water Quality (Continued)

SCREENING CRITERIA	GENERIC RECOMMENDATIONS	ESTIMATED COST	INSTALLATIONS INVOLVED	POTENTIAL BENEFITS TO SURFACE WATER QUALITY
15. Hazardous Waste Pollutants of Concern: Trace organics, heavy metals, chemical agents	a. Implement HM/HW management plan specific to this installation	Prepare RCRA Part B: $70,000 to $350,000 Develop HM/HW Tracking System: Start Up: $380,000-large facility $130,000-small facility Annual Cost: $30,000 -large facility $10,000 -small facility	10 U.S. Naval Academy 23 Naval Shipyard - Norfolk 16 NAB - Little Creek 38 Fort Meade 43 Cameron Station 40 Walter Reed Med. Ctr.	Reduction of toxic organics or heavy metals residuals reduces risk of histopathological abnormalities, metabolic and fecundity suppression, simplification of trophic levels, increase in pollutant tolerant species, and unsuitable spawning and living conditions.
	b. Provide a conforming hazardous waste storage facility	Cost to Construct: $100,000 to $550,000 (size and site dependent) (rough average cost - $125/ft^2)	13 David Taylor - Carderock 47 Fort A. P. Hill 49 Fort Eustis 38 Fort Meade 62 Defense Gen. Sup. Ctr. 12 Naval Med. Com. - NCR 32 Washington Naval Yard 78 Brandywine DRMO	
	c. Re-evaluate management plan for more comprehensive HM/HW controls	Management, not cost related	26 NWS - Yorktown 78 Brandywine DRMO	
	d. Provide for disposal of hazardous waste sludges not under DRMO jurisdiction	Removal/Testing of drums: $200 - $500/drum Install sludge lagoon liners: $100,000 to $500,000 per lagoon	23 Naval Shipyard - Norfolk 49 Fort Eustis 41 Vint Hill Farms Sta.	

Table 5.15 Summary of Generic Recommendations and Their Estimated Costs and Potential Benefits to Surface Water Quality (Continued)

SCREENING CRITERIA	GENERIC RECOMMENDATIONS	ESTIMATED COST	INSTALLATIONS INVOLVED	POTENTIAL BENEFITS TO SURFACE WATER QUALITY
16. SPCC Status Pollutants of Concern: Oil and grease, phenols, POL products, solvents, organics	a. Implement an updated SPCC plan	Update Plan: $10,000 to $50,000 (dependent on need to prepare PPC plan) Construct New Facilities: $100,000-small facility $1,000,000 + - large facility	15 Naval Air Sta. - Oceana 16 NAB - Little Creek 48 Fort Belvoir 47 Fort A. P. Hill 62 Defense Gen. Sup. Ctr. 32 Washington Naval Yard 43 Cameron Station 54 Bolling AFB 78 Brandywine DRMO	Reduction of oil and grease and hydrocarbons reduces long-term sublethal effects on cellular and physiological processes such as feeding and reproduction. Reduction of toxic organics reduces risk of histopathological abnormalities, metabolic and fecundity suppression, simplification of trophic levels, increase in pollutant tolerant species, and unsuitable spawning and living conditions.
	b. Follow SPCC plans in handling abandoned fuel tanks to prevent spills or leaks	Clean up cost (average): $50,000 - one LUST NOTE: Cost range can be extreme	65 Navy SPCC 77 Brandywine RDV 62 Defense Gen. Sup. Ctr.	

Table 5.15 Summary of Generic Recommendations and Their Estimated Costs and Potential Benefits to Surface Water Quality (Continued)

SCREENING CRITERIA	GENERIC RECOMMENDATIONS	ESTIMATED COST	INSTALLATIONS INVOLVED	POTENTIAL BENEFITS TO SURFACE WATER QUALITY
17. Abandoned Sites Pollutants of Concern: Trace organics, heavy metals, hydrocarbons, chemical agents, pesticides, low pH	a. Proceed with next round of confirmation study sampling and testing	<u>Monitoring Cost</u>: $15,000 to $30,000 per site, one time event	26 NWS - Yorktown 27 NSC - Cht. Anx. 83 NSC - Yorktown 22 NSC - Craney Is. 23 Naval Shipyard - Norfolk 16 NAB - Little Creek 30 Allegany Ballist. Lab 34 Aberdoon Proving Ground 52 Andrews AFB 62 Defense Gen. Sup. Ctr. 54 Bolling AFB 5 NOS - Indian Head 17 Sewell's Pt. Navy Cmpx. 36 Letterkenny Army Dep. 38 Fort Meade	Reduction of toxic organics or heavy metals residuals reduces risk of histopathological abnormalities, metabolic and fecundity suppression, simplification of trophic levels, increase in pollution tolerant species, and unsuitable spawning and living conditions. Reduction of oil and grease and hydrocarbons reduces long-term sublethal effects on cellular and physiological processes such as feeding and reproduction.
	b. Eliminate/Control/Treat leachate observed from landfill(s) on this installation	<u>Cost to grade, cap, cover, vegetate, provide erosion/leachate control for 10 acre inactive landfill</u>: $400,000 and up <u>Sludge Lagoon Liner</u>: $100,000 - $500,000	7,8 NAS/NATC - Patuxent 1 USMC - Quantico 49 Fort Eustis 41 Vint Hill Farms Sta. 62 Defense Gen. Sup. Ctr. 39 Fort Detrick	Reduction in pesticides/biocides levels reduces risk of mutagenicity for aquatic biota, destruction of aquatic plants. Avoidance of low pH reduces toxicity of certain compounds in solution, and reduces direct physiological stress to aquatic biota.
	c. Implement containment/control measures as outlined in confirmation study recommendations	<u>Clean-up per site</u>: $150,000 to several million dollars	4 NSWC - White Oak 23 Naval Shipyard - Norfolk 15 NAS - Oceana 65 Navy SPCC 34 Aberdeen Proving Ground 7,8 NAS/NATC - Patuxent 5 NOS - Indian Head	

AD-A190 074 WATER QUALITY ASSESSMENT OF DOD INSTALLATIONS/FACILITIES IN THE CHESAPEAK..(U) TETRA TECH INC ARLINGTON VA NOV 87 DACA31-85-C-0168 5/6

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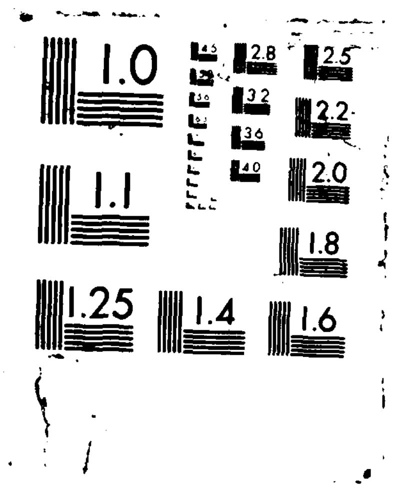
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Table 5.15 Summary of Generic Recommendations and Their Estimated Costs and Potential Benefits to Surface Water Quality (Continued)

SCREENING CRITERIA	GENERIC RECOMMENDATIONS	ESTIMATED COST	INSTALLATIONS INVOLVED	POTENTIAL BENEFITS TO SURFACE WATER QUALITY
17. Abandoned Sites (continued) Pollutants of Concern: trace organics, heavy metals, hydrocarbons, chemical agents, pesticides, low pH	d. Confirm containment/ migration of POL floating on groundwater or soaking soils around tanks	Well Monitoring Program: $50,000 to $250,000 $50,000 - 5 to 10 wells $250,000 - 25 to 50 wells	22 NSC - Craney Is. 23 Naval Shipyard - Norfolk 77 Brandywine RDV 62 Defense Gen. Sup. Ctr. 47 Fort A. P. Hill	Same as above.
	e. Institute confirmation study at site(s) identified in IAS	Confirmation Study: $100,000 to $200,000 per installation $100,000 - 3 to 4 sites $200,000 - 6 to 10 sites	80 HDL - Blossom Pt. 62 Defense Gen. Sup. Ctr. 48 Fort Belvoir	

Table 5.15 Summary of Generic Recommendations and Their Estimated Costs and Potential Benefits to Surface Water Quality (Continued)

SCREENING CRITERIA	GENERIC RECOMMENDATIONS	ESTIMATED COST	INSTALLATIONS INVOLVED	POTENTIAL BENEFITS TO SURFACE WATER QUALITY
18. UST Status Pollutants of Concern: POL products, hydrocarbons, solvents, fuels	a. Test suspect tank(s) for leaks / implement testing in accordance with state and EPA regulations.	Tank Tesk: $400 - $700/tank (size dependent) $1,000 - $3,000/ 20,000 - 1,000,000 gal tank NOTE: Does not include coordination costs	3 Naval Station - Annap. 13 David Taylor - Carderock 83 Naval Sup. Ctr.-Yorktown 22 Naval Sup Ctr-Craney Is. 80 HDL - Blossom Pt. 48 Fort Belvoir 41 Vint Hill Farms Sta. 32 Washington Naval Yard 35 HDL - Adelphi 37 New Cumberland Army Dep. 43 Cameron Station 54 Bolling AFB 34 Aberdeen Proving Ground 1 USMC - Quantico 23 Naval Shipyard - Norfolk 30 Allegany Ballist. Lab 65 Navy SPCC 15 NAS - Oceana 16 NAB - Little Creek	Reduction of oil and grease and hydrocarbons reduces long-term sublethal effects on cellular and physiological processes such as feeding and reproduction. Reduction of toxic organics or heavy metals residuals reduces risk of histopathological abnormalities, metabolic and fecundity suppression, simplification of trophic levels, increase in pollutant tolerant species, and unsuitable spawning and living conditions.
	b. Removal of POL saturated soils surrounding tanks or in drainage ditches to prevent surface water transport	Clean up cost: $50,000 - small leak $350,000 - 2 acre spill site	22 Naval Sup Ctr-Craney Is. 23 Naval Shipyard - Norfolk 15 NAS - Oceana 77 Brandywine RDV	
	c. Implement recommendations to clean up leaked product	Examples: 1) Oil contaminated groundwater recovery system: $70,000 2) Soil clean up: $50,000 - small leak (one tank) $350,000 - large leak (two acres) 3) Fuel recovery from groundwater: $500,000 + (large leak)	77 Brandywine RDV 22 Naval Sup Ctr-Craney Is.	

Table 5.15 Summary of Generic Recommendations and Their Estimated Costs and Potential Benefits to Surface Water Quality (Continued)

SCREENING CRITERIA	GENERIC RECOMMENDATIONS	ESTIMATED COST	INSTALLATIONS INVOLVED	POTENTIAL BENEFITS TO SURFACE WATER QUALITY
19. Forestry Management Pollutants of Concern: TSS	a. Provide enforcement of BMP specifications in the timber sales contracts to ensure erosion and sedimentation does not result from timber sales activities on base.	\$10,000 - \$20,000	1 USMC - Quantico	Reduction in suspended solids increases light penetration, reduces clogging of gills, enhances spawning habitats, reduces smothering of benthic organisms/plants, and reduces transport of heavy metals/organics sorbed to sediment.
20. Wildlife Management	a. Continue/Enhance wildlife management program	\$20,000/yr - average	7,8 NAS/NATC - Patuxent	Enhancement of terrestrial and aquatic habitats and wildlife quality/quantity.
	b. Institute wildlife management program where none now exists	\$10,000/yr - average	85 Naval Com. Unit	
	c. Institute surface water quality monitoring program to insure viability of wildlife management	See recommendation 2c	7,8 NAS/NATC - Patuxent	

Table 5.15 Summary of Generic Recommendations and Their Estimated Costs and Potential Benefits to Surface Water Quality (Continued)

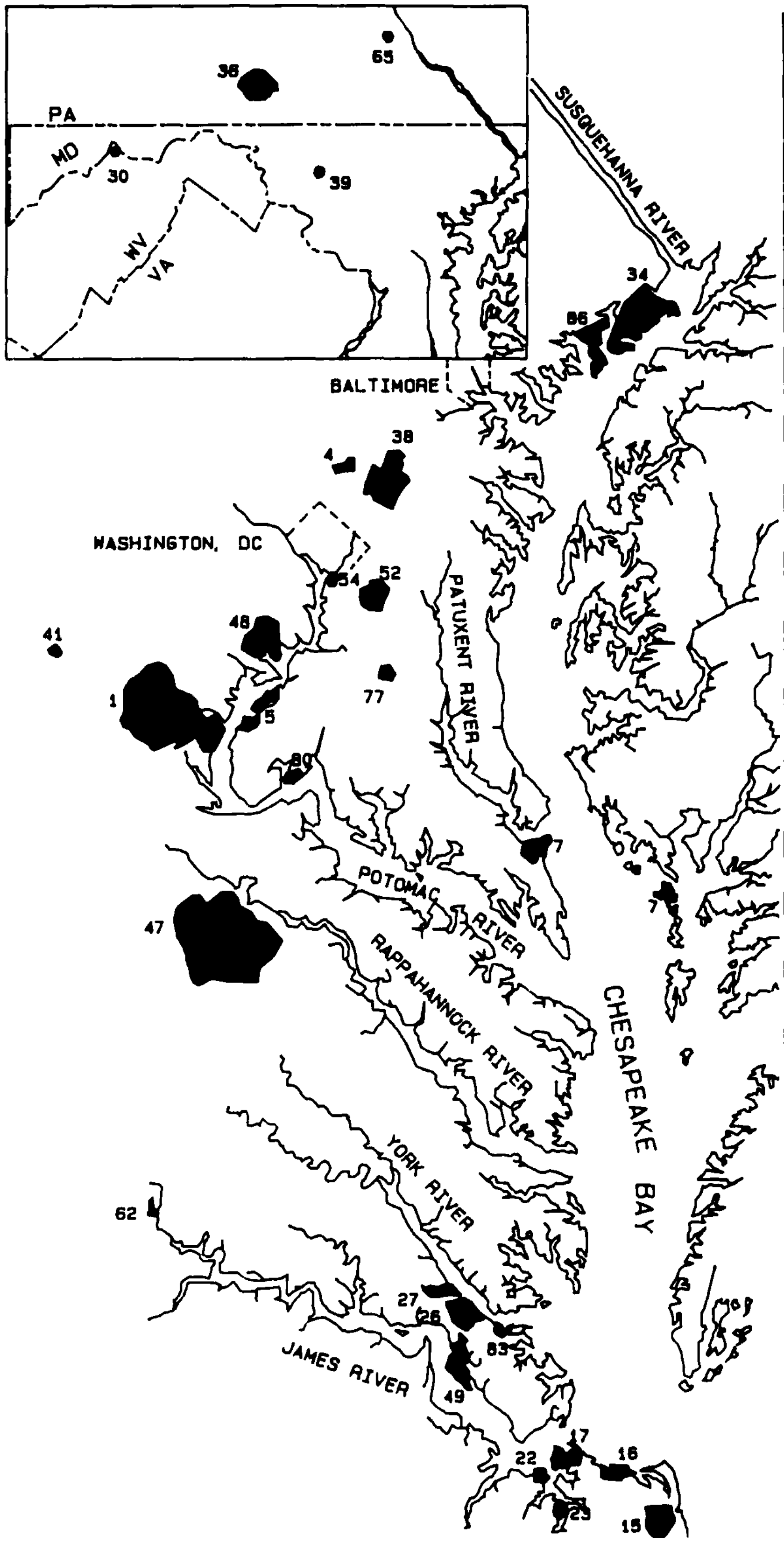
SCREENING CRITERIA	GENERIC RECOMMENDATIONS	ESTIMATED COST	INSTALLATIONS INVOLVED	POTENTIAL BENEFITS TO SURFACE WATER QUALITY
21. Soil Conservation Plan Pollutants of Concern: TSS, nutrients, pesticides	a. Institute soil conservation plan for agricultural outleases on site; i.e., planting cycles, plowing techniques, erosion controls, fertilizer application, pesticide application	Develop Plan: $5,000 to $25,000	7,8 NAS/NATC - Patuxent 16 NAB - Little Creek 36 Letterkenny Army Dep.	Reduction in nutrients decreases likelihood of eutrophication condition (biological nuisances) Reduction in pesticides in runoff decreases likelihood of histopathological abnormalities, metabolic and fecundity suppression, unsuitable spawning and living conditions for fish and benthic biota. Reduction in suspended solids, increases light penetration, reduces clogging of gills, enhances spawning habitats, reduces smothering of benthic organisms and plants, and reduces transport of heavy metals and organics sorbed to sediment.
	b. Review soil conservation plan to ensure BMPs for erosion control	Review sedimentation/erosion control plan for installation and investigate alternatives $30,000 -small facility (<1,000 acres) $200,000 -large facility (>10,000 acres)	36 Letterkenny Army Dep. 1 USMC - Quantico 48 Fort Belvoir 52 Andrews AFB 7,8 NAS/NATC - Patuxent 47 Fort A. P. Hill	

Table 5.15 Summary of Generic Recommendations ant Their Estimated Costs and Potential Benefits to Surface Water Quality (Continued)

SCREENING CRITERIA	GENERIC RECOMMENDATIONS	ESTIMATED COST	INSTALLATIONS INVOLVED	POTENTIAL BENEFITS TO SURFACE WATER QUALITY
22. Stormwater Mgmt. Plan Pollutants of Concern: Oil and grease, trace organics, heavy metals, TSS, BOD	a. Develop a stormwater management plan (i.e., drainage controls, detention systems, erosion controls, oil/water separators, containment systems, monitoring plan.	<u>Develop Plan</u>: $20,000 - $100,000 Dependent on installation size and complexity.	14 David Taylor - Annap. 13 David Taylor - Carderock 15 NAS - Oceana 16 NAB - Little Creek 34 Aberdeen Proving Ground 12 Naval Med. Com. - NCR 1 USMC - Quantico 55 Langley AFB 17 Sewells Pt. Naval Cmpx.	Reduction of oil and grease and hydrocarbons will reduce long-term sublethal effects on cellular and physiological processes such as feeding and reproduction. Reduction of toxic organics or heavy metals residuals reduces risk of histopathological abnormalities, metabolic and fecundity suppression, simplification of trophic levels, increase in pollutant tolerant species, and unsuitable spawning and living conditions. Reduction in BOD will reduce deoxygenation by decaying organic material resulting in higher dissolved oxygen levels for aquatic biota.
	b. Review/Update plan for adequate BMPs (detention basins, oil/water separators, treatment, etc.)	<u>Review/Update Plan</u>: $10,000 - $50,000	7,8 NAS/NATC - Patuxent 1 USMC - Quantico 2 NSWC - Dahlgren 83 NSC - Yorktown 15 NAS - Oceana 65 Navy SPCC 48 Fort Belvoir 52 Andrews AFB	

Table 5.15 Summary of Generic Recommendations and Their Estimated Costs and Potential Benefits to Surface Water Quality (Continued)

SCREENING CRITERIA	GENERIC RECOMMENDATIONS	ESTIMATED COST	INSTALLATIONS INVOLVED	POTENTIAL BENEFITS TO SURFACE WATER QUALITY
23. Wetlands Mgmt. Plan	a. Needs a wetlands management plan, i.e., determine need for control of stormwater runoff, erosion/sedimentation, and pollutant discharges in wetlands areas. Also measures for prevention of damage or destruction to wetlands from training activities, and revegetation of damaged areas.	<u>Cost to Develop</u>: $10,000 - small installation $60,000 - large installation	83 NSC - Yorktown 15 NAS - Oceana 16 NAB - Little Creek 55 Langley AFB 53 Davidsonville RDV 80 HDL - Blossom Pt.	Enhancement of wetland habitats and terrestrial and aquatic wildlife quality/quantity.
24. Shoreline Erosion Plan Pollutants of Concern: TSS, heavy metals	a. Upgrade/Implement erosion control plan Typical plan includes: problem identification; estimation of erosion rates; evaluation of erosion controls - structural vs. vegetative, or both; cost analysis; and implementation plan.	<u>Develop/Upgrade Plan</u>: $20,000 to $60,000	5 NOS - Indian Head 7,8 NAS/NATC - Patuxent 80 HDL - Blossom Point 27 Naval Sup Ctr - Cht. Anx	Reduction in suspended solids will increase light penetration, reduce clogging of gills, enhance spawning habitats, reduce smothering of benthic organisms/plants, and reduce transport of heavy metals/organics sorbed to sediment.



CRITERION 17 - ABANDONED SITES

General Concern - Migration of toxic contaminants to local surface waters from abandoned hazardous waste disposal or spill sites.

<u>Recommendation 17a</u> - Proceed with next round of Confirmation Study sampling and testing.

26 Naval Weapons Station-Yorktown
27 NSC - Cheatham Annex
83 NSC - Yorktown
22 NSC - Craney Island
23 Naval Shipyard - Norfolk
16 NAB - Little Creek
30 Allegany Ballistics Lab
34,86 Aberdeen Proving Ground
52 Andrews AFB
54 Bolling AFB
62 Defense General Supply Center
5 Naval Ordnance Sta.-Indian Head
17-21 Sewells Point Naval Complex
36 Letterkenny Army Depot
38 Fort Meade

<u>Recommendation 17b</u> - Eliminate/control/treat leachate from landfills.

7,8 NAS/NATC - Patuxent River
1 USMC/MCDEC - Quantico
49 Fort Eustis
41 Vint Hill Farms Station
62 Defense General Supply Center
39 Fort Detrick

<u>Recommendation 17c</u> - Implement containment control measures as outlined in Confirmation Study.

4 NSWC - White Oak
23 Naval Shipyard - Norfolk
15 NAS - Oceana
65 NSPCC - Mechanicsburg, PA
34,86 Aberdeen Proving Ground
7,8 NAS/NATC Patuxent River
5 Naval Ordnance Sta.-Indian Head

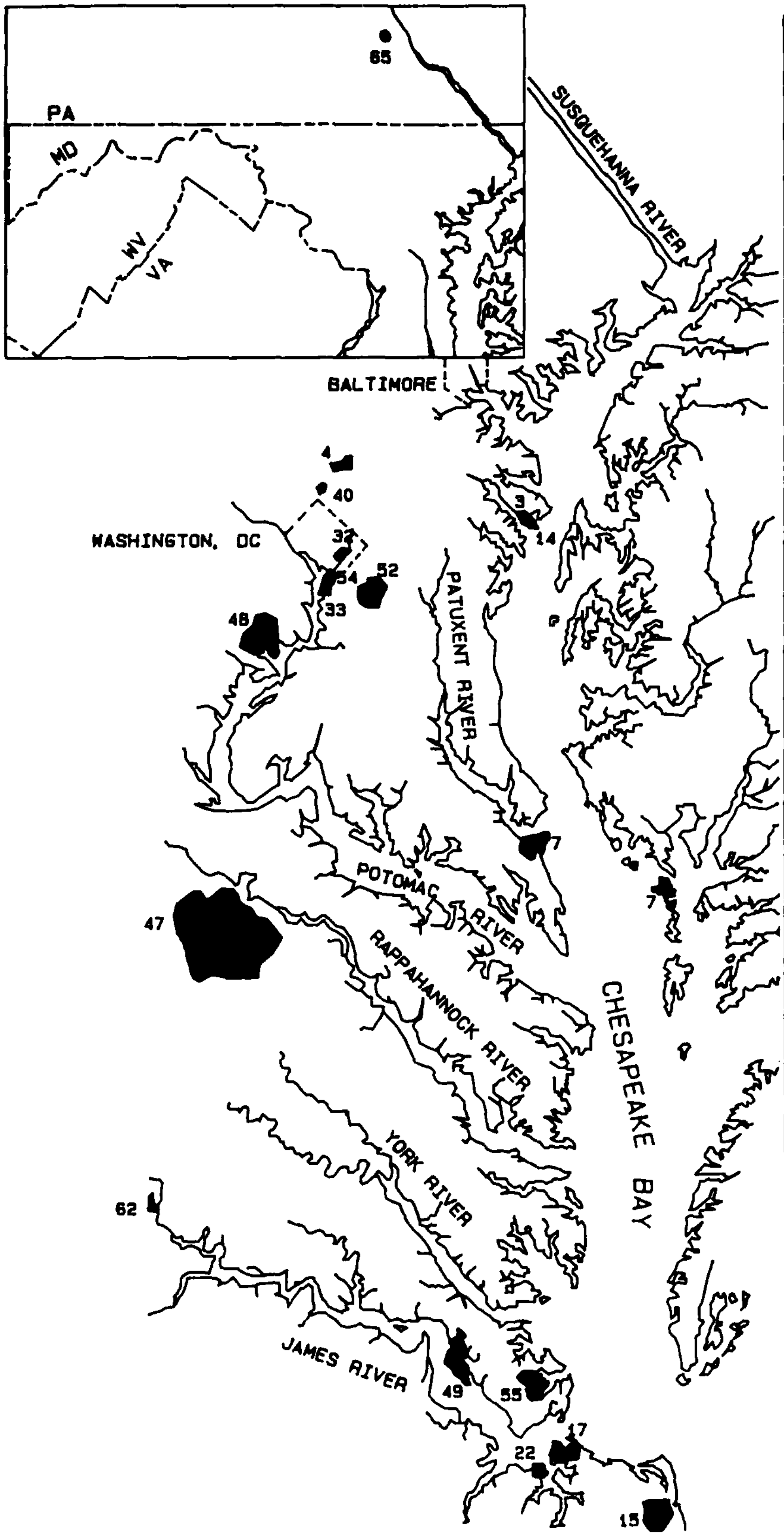
<u>Recommendation 17d</u> - Confirm containment/migration of POL floating on ground water or in soil near tanks.

22 NSC - Craney Island
23 Naval Shipyard - Norfolk
77 Brandywine RDV
62 Defense General Supply Center
47 Fort A.P. Hill

<u>Recommendation 17e</u> - Implement Confirmation Study at site(s) identified in IAS.

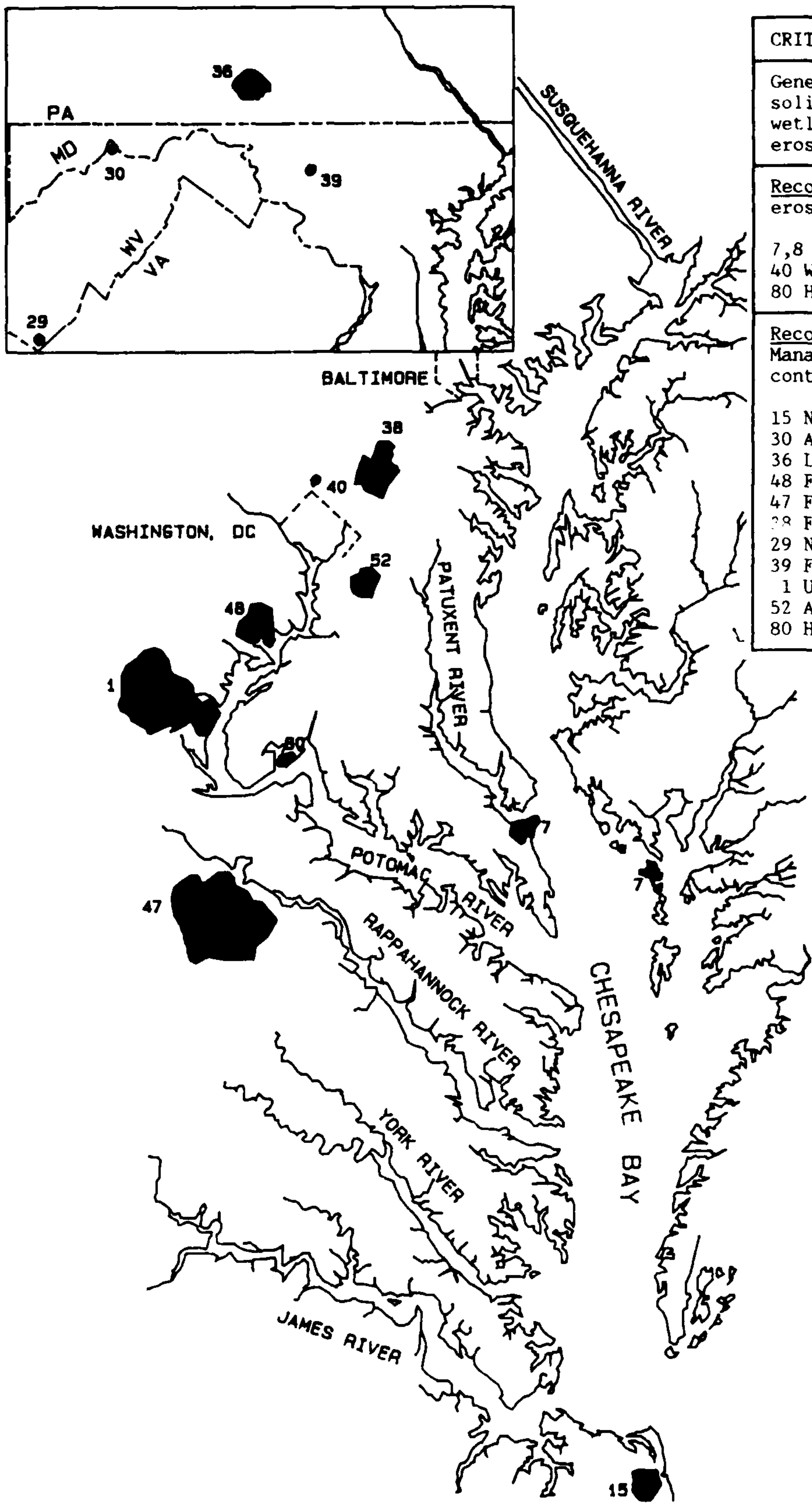
80 HDL - Blossom Point
48 Fort Belvoir
62 Defense General Supply Center

Figure 5.9 Summary of Recommended Actions and Installation Locations for Criterion 17 - Abandoned Waste Sites (Rank 1 of 18).



CRITERION 2 - IMPERV. AREA RUNOFF
General Concern - Contaminants carried by storm runoff from impervious areas and associated activities (fuel storage/handling, air fields, vehicle maintenance, etc.
<u>Recommendation 2a</u> - Oil/water separators are needed to intercept impervious area runoff. 2 NSWC - Dahlgren 4 NSWC - White Oak 52 Andrews Air Force Base 55 Langley Air Force Base 32 Washington Navy Yard 33 Naval Research Lab - Wash., DC 7,8 NAS/NATC - Patuxent River
<u>Recommendation 2b</u> - Upgrade oil/water separators to handle high wet weather runoff, high tides. 22 NSC - Craney Island 15 Naval Air Station - Oceana 65 Navy Ships Parts Control Center 49 Fort Eustis 52 Andrews Air Force Base 62 Defense General Supply Center 54 Bolling Air Force Base
<u>Recommendation 2c</u> - Institute surface water monitoring program to determine presence and need for control of contaminants. 48 Fort Belvoir 47 Fort A.P. Hill 49 Fort Eustis 55 Langley Air Force Base 65 Navy Ships Parts Control Center 12 Naval Medical Center - NCR 40 Walter Reed Army Medical Center 62 Defense General Supply Center 17-21 Sewells Point Naval Complex 7,8 NAS/NATC - Patuxent River 15 Naval Air Station - Oceana 4 NSWC - White Oak 14 David Taylor NSRDC - Annapolis 52 Andrews Air Force Base

Figure 5.10 Summary of Recommended Actions and Installation Locations for Criterion 2 - Impervious Area Runoff (Rank 2 of 18).



CRITERION 1 - EROSION/SILTATION

General Concern - High suspended solids, destruction of benthic/ wetland habitats from accelerated erosion.

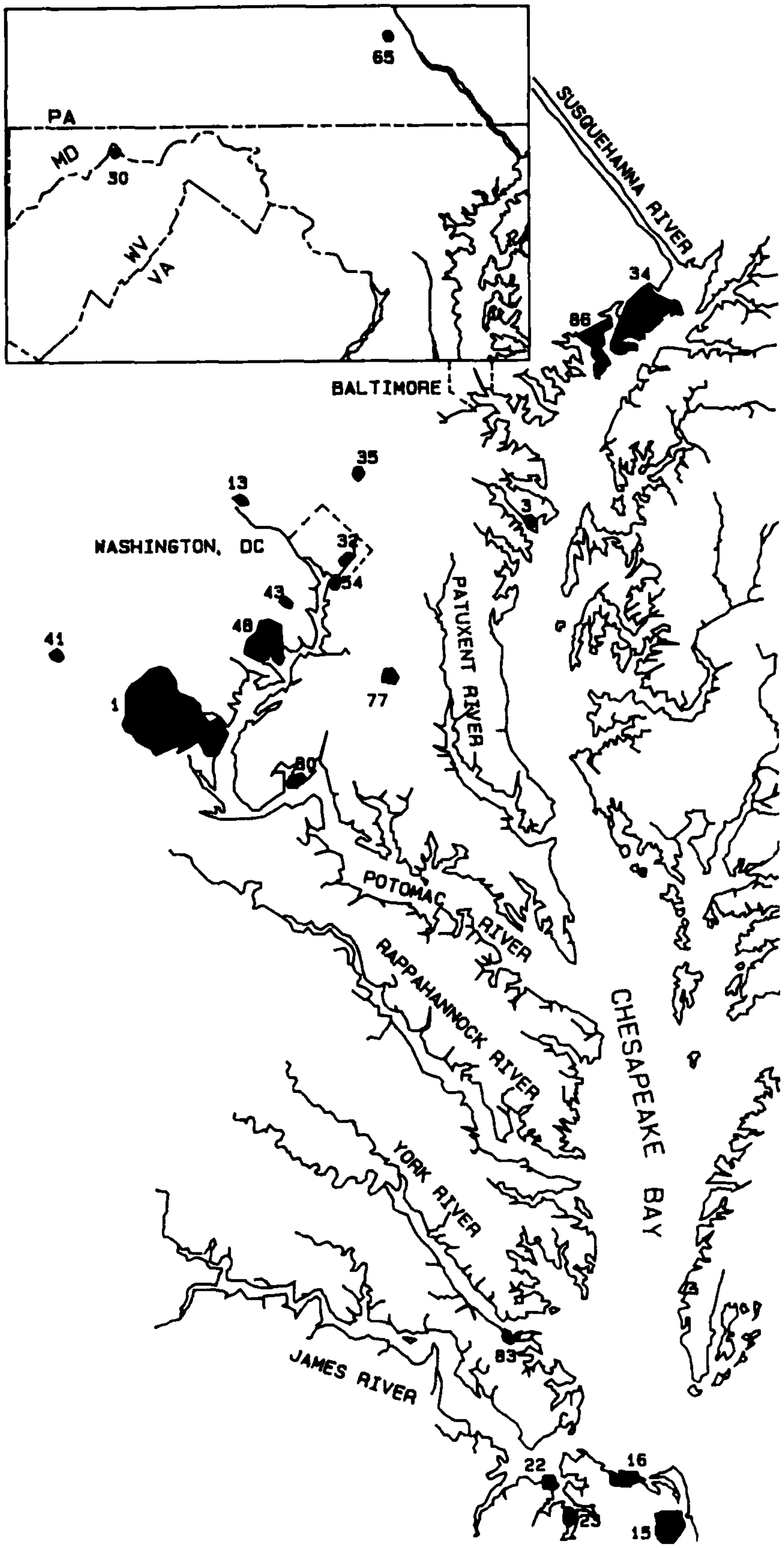
Recommendation 1a - Control soil erosion in and around landfills.

7,8 NAS/NATC - Patuxent River
40 Walter Reed Army Medical Center
80 HDL - Blossom Point

Recommendation 1b - Implement Best Management Practices for erosion control and soil conservation.

15 NAS - Oceana
30 Allegany Ballistics Lab
36 Letterkenny Army Depot
48 Fort Belvoir
47 Fort A.P. Hill
38 Fort Meade
29 Naval Radio Sta. - Sugar Grove
39 Fort Detrick
1 USMC/MCDEC - Quantico
52 Andrews AFB
80 HDL - Blossom Point

Figure 5.11 Summary of Recommended Actions and Installation Locations for Criterion 1 - Erosion/Siltation (Rank 3 of 18).



CRITERION 18 - UST STATUS
General Concern - Leakage of POL products from underground storage tanks to ground water and possible migration to surface waters.
<u>Recommendation 18a</u> - Test suspicious tanks for leaks; or implement testing in accordance with state/federal regulations when they become effective. 3 Naval Station, Annapolis 13 DTNSRDC - Carderock 83 NSC - Yorktown 22 NSC - Craney Island 80 HDL - Blossom Point 48 Fort Belvoir 41 Vint Hill Farms Station 32 Washington Navy Yard 35 HDL - Adelphi 37 New Cumberland Army Depot 43 Cameron Station 54 Bolling AFB 34,86 Aberdeen Proving Ground 1 USMC/MCDEC - Quantico 30 Allegany Ballistics Lab 15 Naval Air Station - Oceana 16 NAB - Little Creek 65 Navy Ships Parts Control Center 23 Naval Shipyard - Norfolk
<u>Recommendation 18b</u> - Remove POL saturated soils surrounding tanks or in trainage ditches to prevent surface water transport. 22 NSC - Craney Island 23 Naval Shipyard - Norfolk 15 Naval Air Station - Oceana 77 Brandywine Rec. & Housing Annex
<u>Recommendation 18c</u> - Implement recommendations to clean up leaked POL product. 77 Brandywine Rec. & Housing Annex 22 NSC - Craney Island

Figure 5.12 Summary of Recommended Actions and Installation Locations for Criterion 18 - UST Status (Rank 4 of 18).

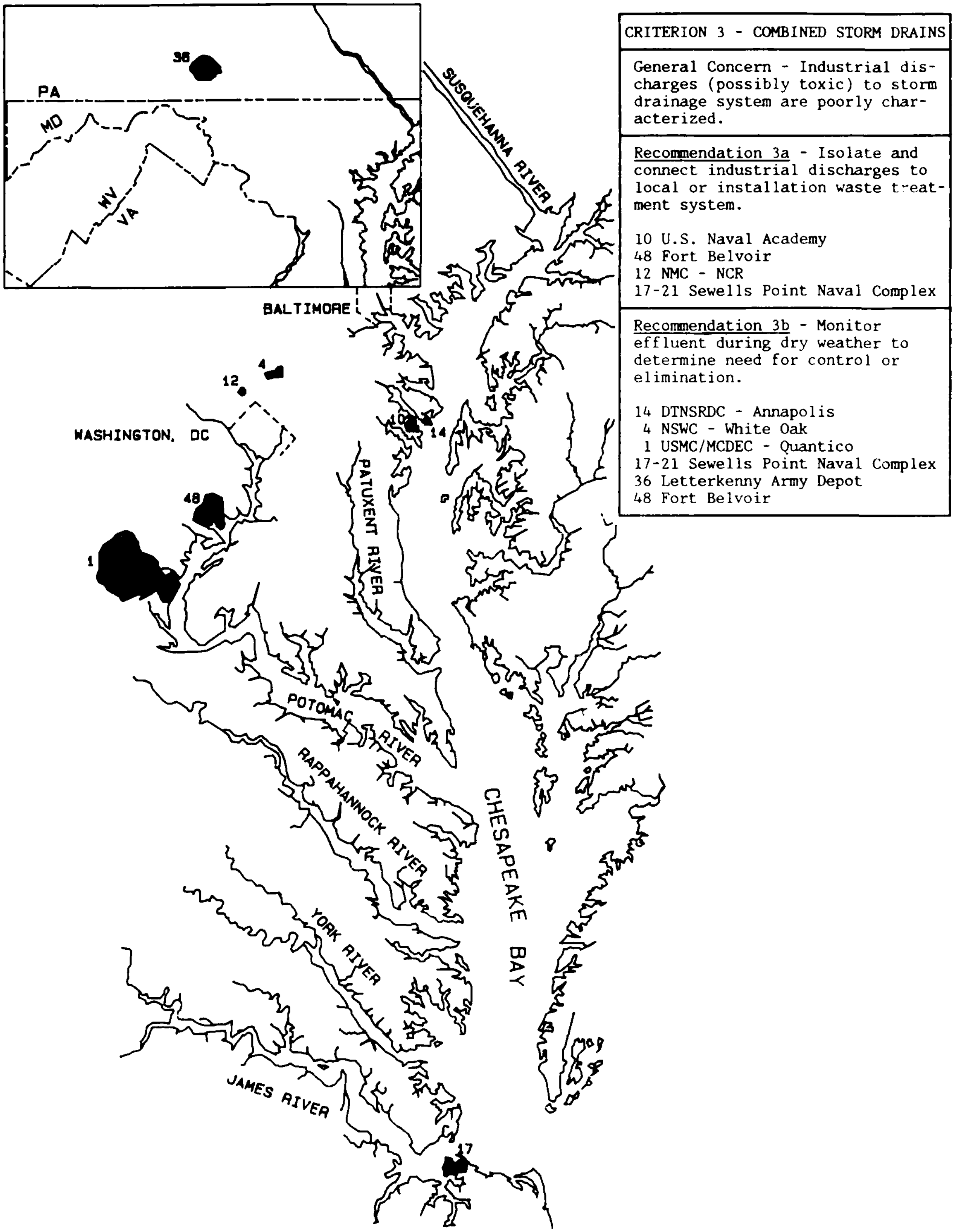
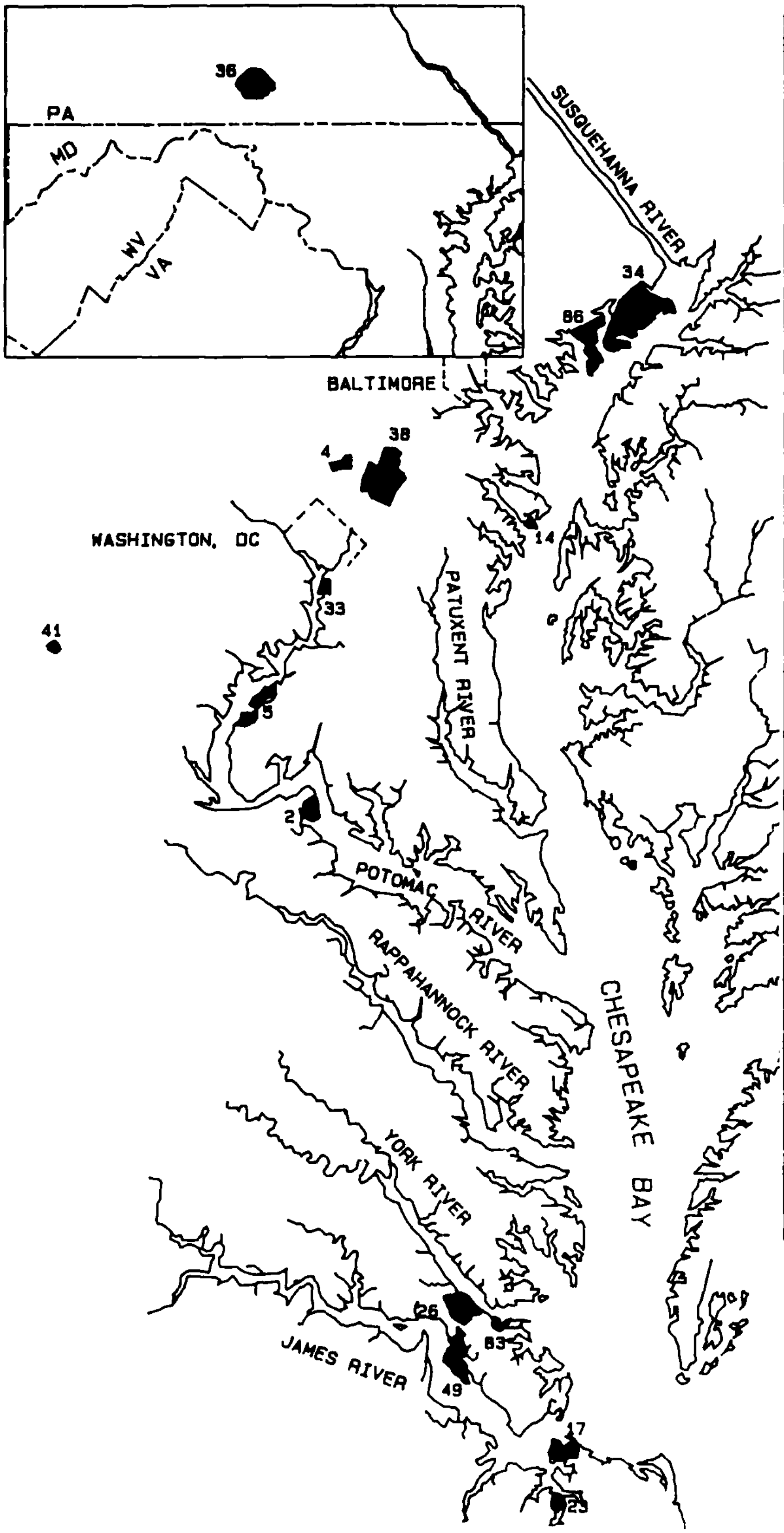


Figure 5.13 Summary of Recommended Actions and Installation Locations for Criterion 3 - Combined Industrial/Storm Drains (Rank 5 of 18).



CRITERION 6-INDUSTRIAL WASTE TREAT.

General Concern - Discharge of toxics to local surface waters.

Recommendation 6a - Obtain NPDES permit and/or monitor discharge as required by NPDES permit.

14 DTNSRDC - Annapolis
5 NOS - Indian Head
83 NSC - Yorktown
36 Letterkenny Army Depot

Recommendation 6b - Install/service/upgrade oil/water separators to intercept effluent.

4 NSWC - White Oak
49 Fort Eustis

Recommendation 6c - Install/upgrade pretreatment systems prior to discharge (see Recommendation 6e below).

5 NOS - Indian Head
2 NSWC - Dahlgren
23 Naval Shipyard - Norfolk
34,86 Aberdeen Proving Ground
41 Vint Hill Farms Station
33 Naval Research Lab - Wash., DC

Recommendation 6d - Review pretreatment process and operations to improve effluent quality.

5 NOS - Indian Head
2 NSWC - Dahlgren
26 NWS - Yorktown
17-21 Sewells Point Naval Complex
23 Naval Shipyard - Norfolk
36 Letterkenny Army Depot
38 Fort Meade
49 Fort Eustis

Recommendation 6e - Implement an effluent toxics monitoring program to determine pretreatment needs, if any.

5 NOS - Indian Head
2 NSWC - Dahlgren
23 Naval Shipyard - Norfolk
34,86 Aberdeen Proving Ground
41 Vint Hill Farms Station

Figure 5.14 Summary of Recommended Actions and Installation Locations for Criterion 6 - Industrial Waste Treatment (Rank 6 of 18).

CRITERION 8 - REFUELING OPERATIONS
General Concern - Inadequate control of runoff from fuel storage and fuel transfer areas into local surface waters.
<u>Recommendation 8a</u> - Provide containment and spill prevention measures as required. 83 NSC - Yorktown 55 Langley Air Force Base 62 Defense General Supply Center 44 Fort McNair 17 Sewells Point Naval Complex 52 Andrews Air Force Base

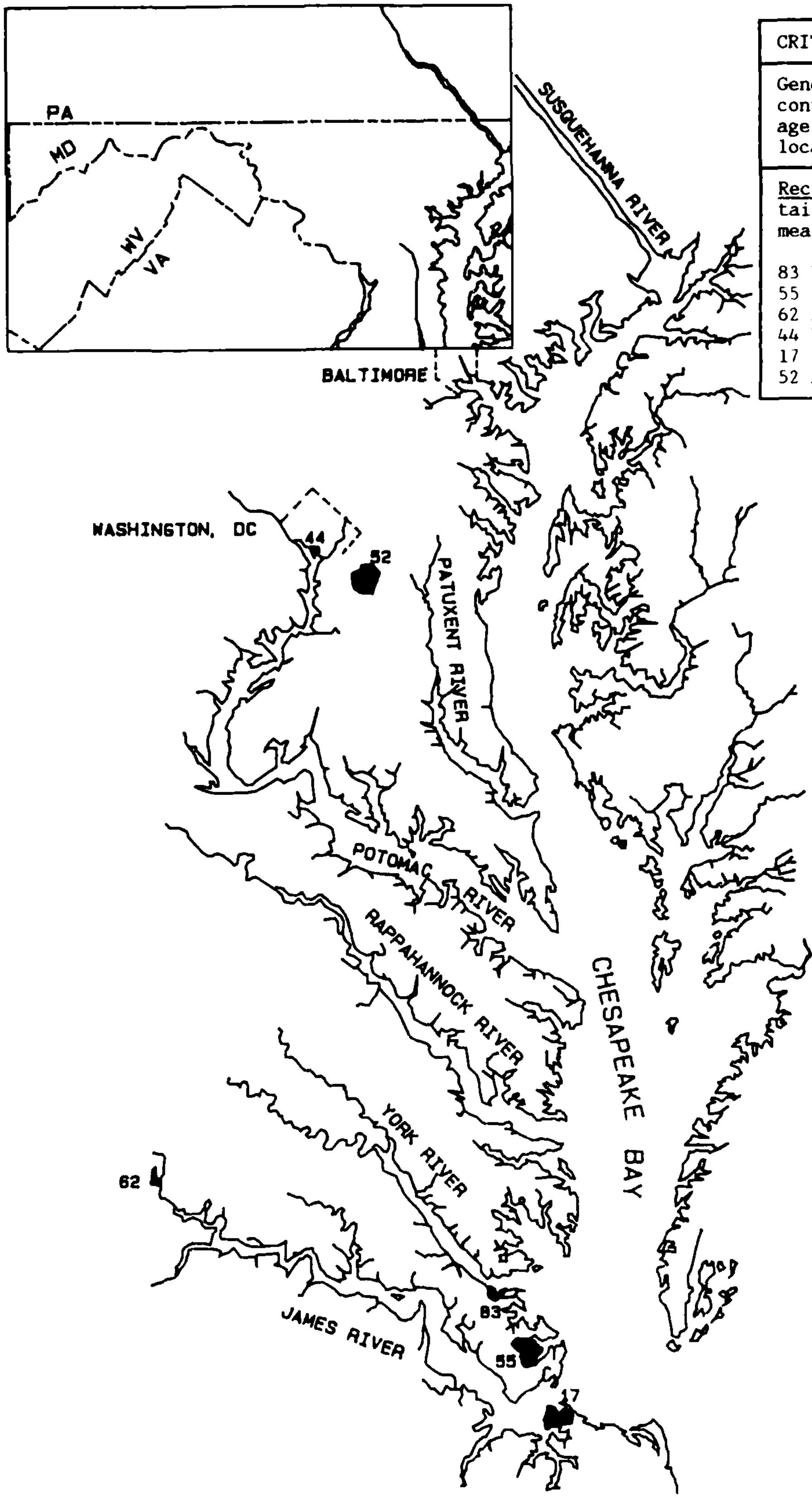
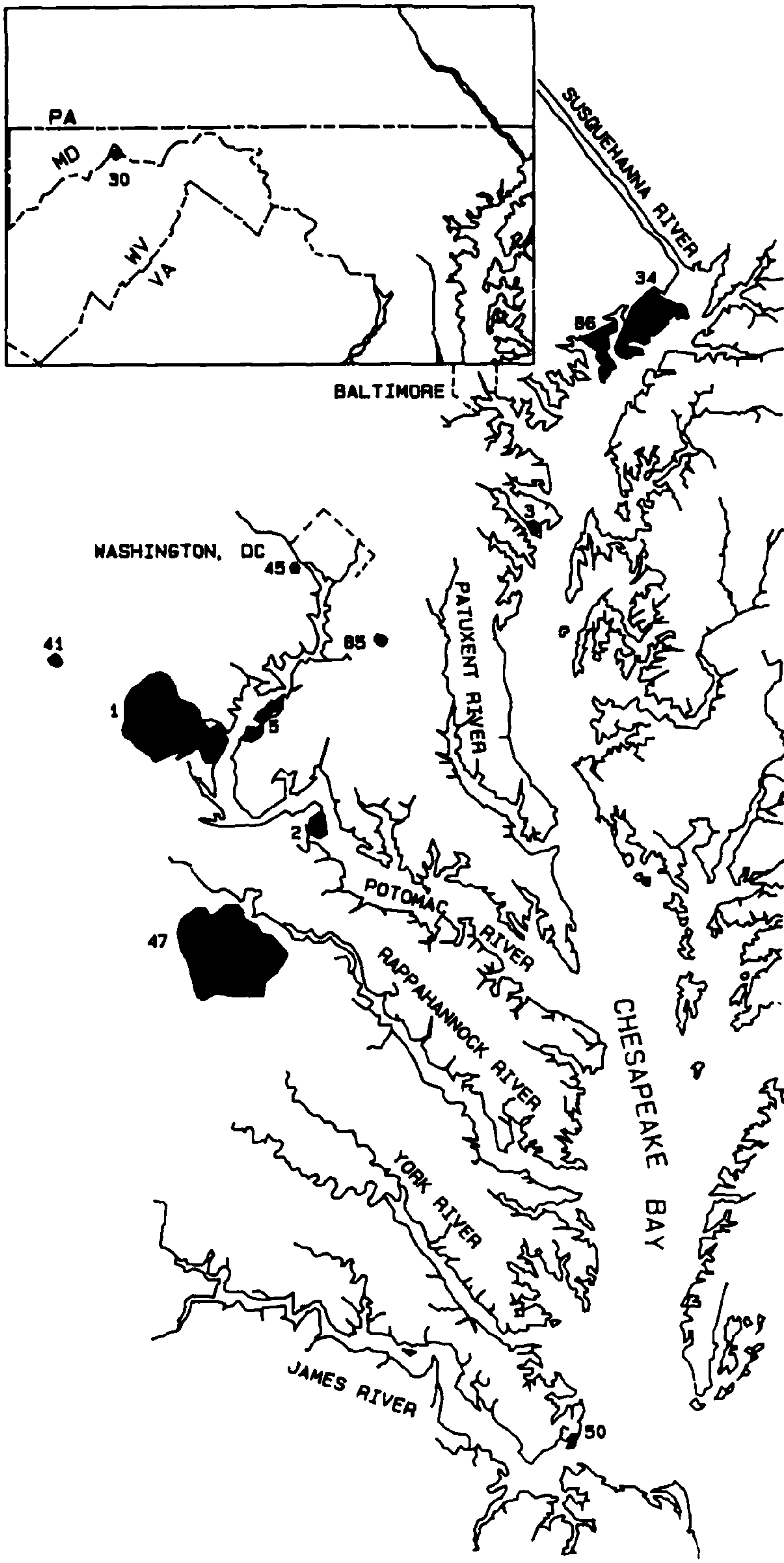


Figure 5.15 Summary of Recommended Actions and Installation Locations for Criterion 8 - Refueling Operations (Rank 7 of 18).



CRITERION 15 - HAZARDOUS WASTE

General Concern - Reduce risk of catastrophic release of toxic materials into surface waters.

<u>Recommendation 15a</u> - Implement/update HM/HW management plan specific to this installation.

10 U.S. Naval Academy
23 Naval Shipyard - Norfolk
16 NAB - Little Creek
38 Fort Meade
43 Cameron Station
40 Walter Reed Army Medical Center

<u>Recommendation 15b</u> - Provide a conforming HW storage facility for the installation.

13 David Taylor NSRDC - Carderock
47 Fort A.P. Hill
49 Fort Eustis
38 Fort Meade
62 Defense General Supply Center
12 Naval Medical Center - NCR
32 Washington Navy Yard
78 Brandywine DRMO

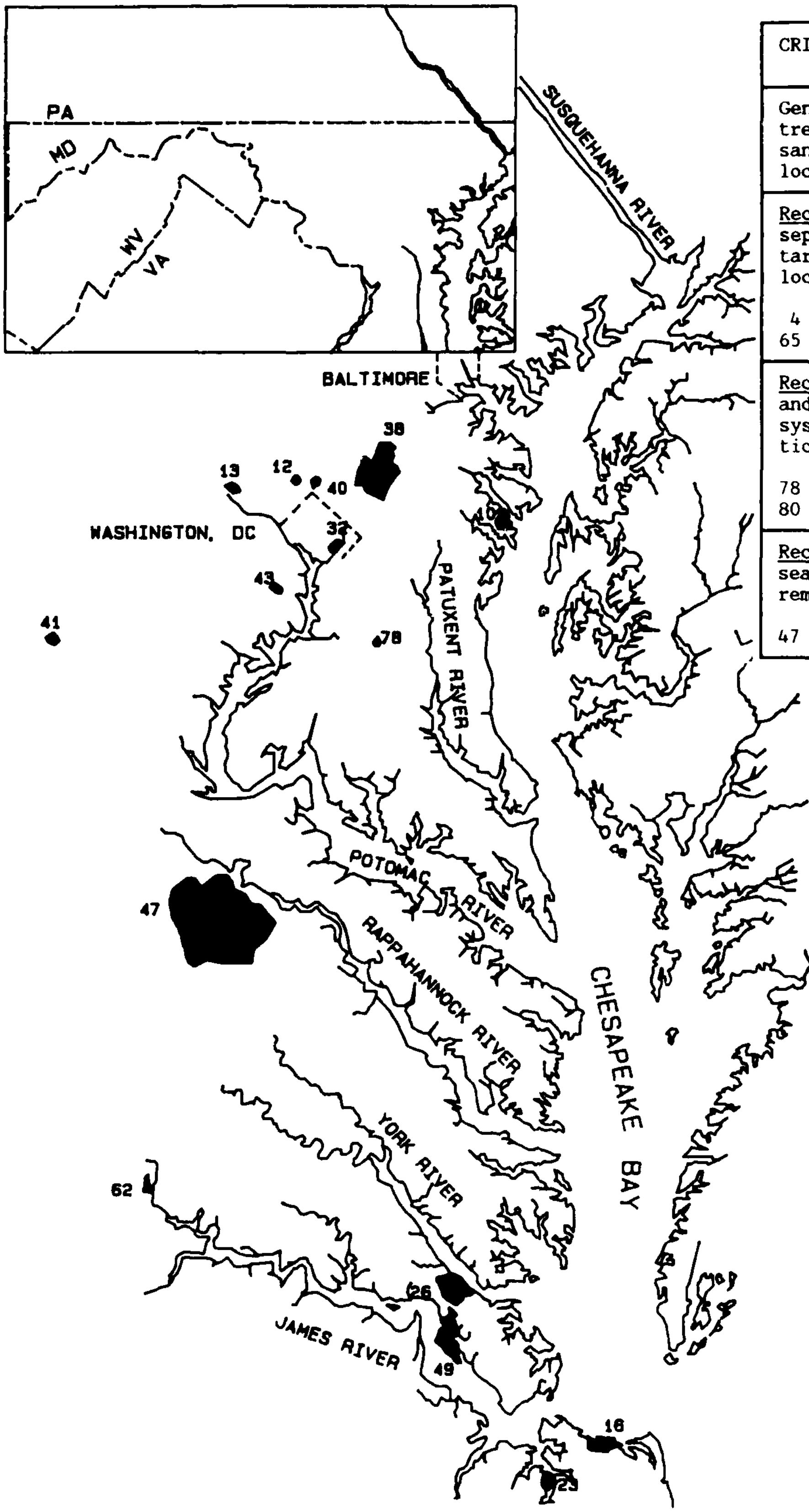
<u>Recommendation 15c</u> - Re-evaluate management plan for more comprehensive HM/HW controls.

23 Naval Shipyard - Norfolk
78 Brandywine DRMO

<u>Recommendation 15d</u> - Provide for disposal of hazardous waste sludge not under DPDO jurisdiction.

23 Naval Shipyard - Norfolk
49 Fort Eustis
41 Vint Hills Farm Station

Figure 5.16 Summary of Recommended Actions and Installation Locations for Criterion 15 - Hazardous Waste (Rank 8 of 18).



CRITERION 7-INTERMITTENT SEWAGE TREATMENT

General Concern - Inadequate treatment of remote or seasonal sanitary waste, contamination of local ground and surface waters.

Recommendation 7a - Connect remote septic systems to existing sanitary sewer lines for treatment at local STP.

4 NSWC - White Oak
65 Navy Ships Parts Control Center

Recommendation 7b - Check, clean, and replace or relocate septic systems as required after inspection.

78 Brandywine DRMO
80 Harry Diamond Lab-Blossom Point

Recommendation 7c - Provide for seasonal treatment or sewers at remote campsites.

47 Fort A.P. Hill

Figure 5.17 Summary of Recommended Actions and Installation Locations for Criterion 7 - Intermittent Sewage Treatment (Rank 9 of 18).

CRITERION 16 - SPCC STATUS

General Concern - Release of pollutants such as oil & grease, phenols, POL products, solvents, and organics to surface waters.

Recommendation 16a - Implement an updated SPCC plan in accordance with environmental regulations.

15 Naval Air Station - Oceana
16 NAB - Little Creek
48 Fort Belvoir
62 Defense General Supply Center
32 Washington Navy Yard
47 Fort A.P. Hill
43 Cameron Station
54 Bolling AFB
78 Brandywine DRMO

Recommendation 16b - Follow SPCC plans in handling abandoned fuel tanks to prevent spills or leaks.

65 Navy Ships Parts Control Center
77 Brandywine Rec. & Housing Annex
62 Defense General Supply Center

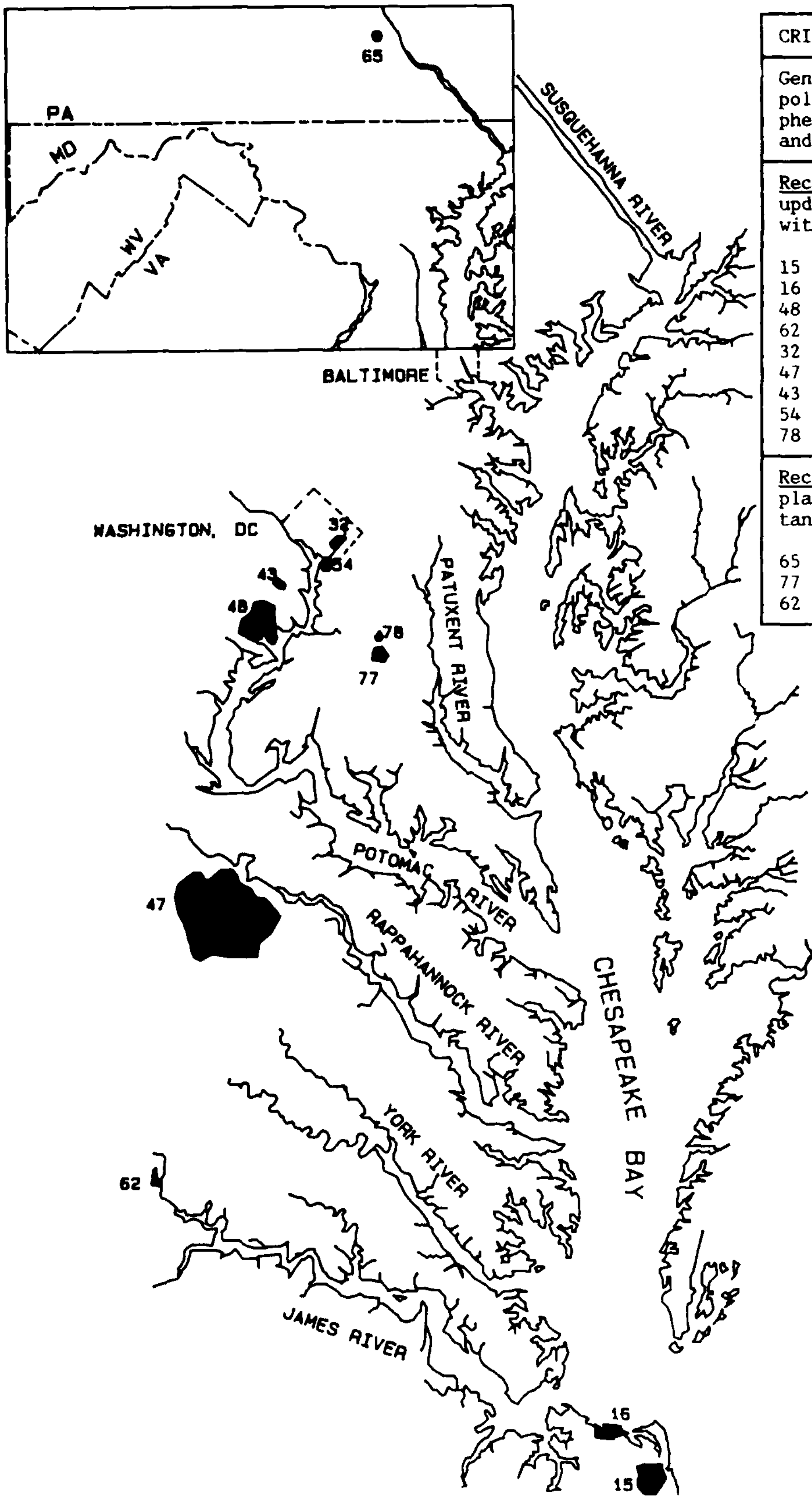


Figure 5.18 Summary of Recommended Actions and Installation Locations for Criterion 16 - SPCC Status (Rank 10 of 18).

6.0 PROJECT SUMMARY

This section summarizes the major findings, conclusions, and recommendations from the Phase III analysis of the 66 DoD installations. Many of the findings have been updated since the preliminary findings in the Phase I and Phase II reports (Tetra Tech, 1986, 1987).

6.1 GENERAL FINDINGS

- With the exception of the Naval Surface Weapons Center at Dahlgren, Harry Diamond Labs-Blossom Point, and Aberdeen Proving Ground, the military activities appear to play a minor role in the regional or far-field water quality conditions of Chesapeake Bay. Dahlgren, Blossom Point, and Aberdeen Proving Ground, however, are unique because of the impacts of ordnance shelling over large test ranges in the adjacent open waters and/or on-site wetland areas. In terms of conventional pollutants (BOD, nutrients, sediments), the military installations appear to contribute a relatively insignificant loading of pollutants to the Chesapeake Bay and tributaries, compared to surrounding point and nonpoint sources.

- The most beneficial programs at the military installations are related to: sewage treatment plant upgrades or connection to a municipal treatment system; upgrading of hazardous waste storage/handling facilities and procedures; implementation of SPCC plans and procedures for containment of fuel spills; and implementation of natural resource management plans.

- Areas that represent ongoing concerns at the military installations relate primarily to activities that are difficult to control or regulate. They include: stormwater runoff; dispersed, intermittent sources of industrial (toxic) pollutants to sewage treatment systems and/or to storm drains (which are permitted and tested only for conventional pollutants); and abandoned or inactive hazardous waste disposal sites.

- The discharge of toxics from poorly defined point and nonpoint sources (including abandoned waste disposal sites) is potentially the most important issue related to the preservation of water quality on or near the military installations. Certain toxic constituents (e.g., hydrophobic organic compounds such as pesticides, polynuclear aromatic hydrocarbons, and halogenated hydrocarbons and inorganic compounds such as heavy metals) are of special concern due to their tendency to adsorb to sediment and to accumulate in the estuarine sediment bed, where benthic organisms are exposed over long periods of time. There is insufficient quantitative data and information at most installations, however, to accurately assess the need for specific controls or cleanup of toxic pollutant sources. Despite the compilation of an extensive data

base for this study, few suitable data sets exist to determine whether a cause and effect relationship exists between installation contaminant sources and water quality impacts. This becomes even more apparent in situations where vicinity contaminant sources overlap and/or obscure contaminant sources from the military installation (e.g., Skiffes Creek at Fort Eustis). Installations which have exhibited toxic contamination of local surface waters, based on preliminary, limited data, include Aberdeen Proving Ground, NOS-Indian Head, Naval Shipyard-Norfolk, Naval Supply Center-Yorktown, Naval Weapons Station-Yorktown, and Vint Hill Farms Station.

- Because of insufficient quantitative data and information, one of the most frequently made recommendations for the military installations is to adopt a periodic monitoring program for: 1) toxics in the sewage or industrial waste treatment plant effluent; 2) toxics in intermittent stormwater drainage; and 3) field monitoring for conventionals and toxics in receiving waters and sediments in the immediate vicinity of the installation. Although these activities are not currently required, it is believed that NPDES permit requirements will be upgraded by the EPA to include monitoring for toxic pollutants. At Fort Eustis, for example, an Effluent Toxics Monitoring Program has been recently instituted to determine the need for pretreatment and/or elimination of several minor industrial waste processes discharging to the on-post sewage treatment system. At NOS Indian Head, a major feasibility study is underway to design a series of industrial waste treatment systems to consolidate and treat approximately 48 intermittent industrial discharges/combined storm drains in conjunction with a revised NPDES permit to control and monitor industrial pollutants. As a way of anticipating changes to the regulatory requirements regarding toxics, it may be in the best interest of DoD to conduct a certain level of "self-monitoring" in order to plan appropriately, as well as to isolate the effects of military activities from upstream or possibly overlapping pollutant sources.

6.2 DOD ENVIRONMENTAL ENHANCEMENT PROGRAMS

In general, the environmental enhancement programs at the military installations are very progressive. In recent years, DoD has taken steps to eliminate and/or reduce the direct discharge of pollutants to local receiving waters. Primary examples of areas where DoD operations have been particularly beneficial to water quality conditions include:

1. Preservation of undeveloped land - this helps stabilize the soil and reduces surface runoff of pollutants and erosion rates;

2. Maintenance and implementation of natural resources programs, soil conservation plans, wetlands management programs, forestry management plans - these programs provide a mechanism to

implement proper BMPs to preserve and enhance the environmental resources on the installation;

3. Sewage treatment - in recent years, a significant effort has been made to upgrade sewage treatment systems on the installations (several to AWT or tertiary systems) and to conform to regulatory requirements. Another active program has involved the tie-in of sewage lines directly to the local municipal system for treatment.

4. Hazardous waste storage and handling - despite ongoing problems with the removal of hazardous waste from military installations, great progress has been made in upgrading HW storage and handling facilities and in reducing instances of spill events.

5. Environmental Assistance Programs - the IRP/NACIP programs are active at all installations where potential contamination from past disposal practices has been identified. These programs, sponsored by USATHAMA (Army), NEESA (Navy) and OEHL (Air Force), provide a mechanism to identify and prioritize sources of contamination from past disposal practices, especially related to the release of hazardous and toxic chemicals/substances into groundwater or surface waters/sediments.

Activities at DoD installations which can affect the environment are extremely varied and complex (e.g., munitions production and testing, troop training activities). These activities have existed at most installations for several decades. During this time (as with private industry) manufacturing processes and disposal procedures were established with little consideration of the consequences to water quality and the environment. The current generation of the military has the difficult task of dealing with these past practices and establishing new procedures which can accomplish the military mission while maintaining a healthier environment. DoD has come a long way in dealing with this problem and in accelerating its attempts to deal with the many changes in both actions and attitudes which will be needed in order to accomplish this goal.

Throughout DoD, a number of programs have been instituted which have resulted in significant environmental benefits and which have demonstrated DoD's resolve to reverse the problems created by past practices. Some of these programs are presented below:

IRP/NACIP - The establishment of a systematic program to identify and clean up abandoned toxic and hazardous waste sites is common to all DoD services. The Army has tasked USATHAMA to deal with these sites on their installations and on DLA installations. The Navy has accomplished most of this through the NAVFAC EFDs with aid from NEESA, and the Air Force program is sponsored by OEHL. All three programs can be considered aggressive and are having a beneficial effect. The reduction and/or elimination of toxics or hazardous

waste migration in groundwater is an important aspect of DoD's water quality improvement programs.

Defense Environmental Restoration Account Program (DERA) - The IRP/NACIP activities are directed under the DERA program, which is DoD's implementation of the Superfund Amendments and Reauthorization Act (SARA) of 1986. The major goals of DERA include: (1) identification, investigation and cleanup of contamination from hazardous substances; (2) correction of other environmental damage which creates an imminent and substantial endangerment to the public health or welfare or the environment; and (3) demolition and removal of unsafe buildings and structures. The DERA is focusing on the cleanup of past hazardous waste disposal sites on DoD installations.

Environmental Assistance Programs - DoD services provide additional environmental engineering assistance to installations, as requested, through a number of programs designed to deal with specific health-related problems. The Army's AEHA, the Engineering Field Divisions of NAVFAC (CHESDIV and LANTDIV) in the Navy and OEHL in the Air Force all respond to requests by the installations for tasks ranging from laboratory analyses of suspected toxic materials to full scale environmental audits and environmental impact statements. These programs greatly enhance the capabilities of the installation environmental coordinator in assessing and in dealing with water quality problems.

Defense Environmental Status Reports (DESR) - The input of the services to the DESR is an aid to the DoD environmental programs, providing an up-to-date assessment of how the individual installations and services are progressing with environmental programs. It can help to highlight areas needing priority attention and aid in the funding of necessary projects.

DoD Environmental Audit Program - The performance of environmental audits on the installations on a three-year cycle is one of the best examples of ongoing programs to assess an installation's water quality needs. This program can also help to establish priorities at the installations.

Advanced Wastewater Treatment (AWT) Upgrades - A number of installations have upgraded their sewage treatment plants by incorporating AWT practices. Denitrification, phosphorous removal, UV disinfection, and multi-media sand filters are examples of AWT procedures which have been implemented by DoD in the Chesapeake Bay Region.

Resource Management Programs - Programs which manage land use and resources also have the potential to benefit water quality and resource habitat. These include forestry programs, wetlands programs, soil conservation programs, stormwater management activities, shoreline erosion control, etc.

OMTAP Program - DoD's Operation, Maintenance and Training Assistance Program (OMTAP) is a pilot program designed to enhance sewage treatment plant operations at selected facilities through site-specific evaluation, analysis, and assistance. OMTAP uses a detailed on-site evaluation of each management, support, and operating function of a STP to identify both short- and long-term problems, and to recommend changes to improve the operations and effectiveness of the plant.

Environmental Awards - Each year DoD sponsors, within each service, an environmental awards program which is designed to promote competition between installations for environmental excellence. The awards program has promoted environmental concern at the installation level and has provided the incentive for implementation of progressive environmental programs.

DoD has performed especially well in areas that have required direct response to Federal and State regulatory procedures. Examples include sewage treatment (NPDES -Clean Water Act), hazardous waste storage and disposal (RCRA), SPCC programs (Clean Water Act), and investigation of abandoned hazardous substances disposal sites (CERCLA). On the other hand, improved performance is needed in areas that are relatively ineffectively regulated by Federal and State laws. These include control of toxic substances in sewage and industrial waste treatment systems, control of miscellaneous industrial discharges in combined storm drains, and control of pollutants in stormwater runoff. These are among the most important problems requiring improved performance at the military installations. It is important to note that there is a tendency by the EPA for more stringent controls and monitoring of NPDES permits to include priority pollutants and other toxic substances. The fact of good compliance with a discharge permit, based only on conventional constituents, may obscure contaminant contributions from the installation in non-monitored areas.

6.3 GENERAL RECOMMENDATIONS

The following paragraphs address specific water quality related areas of concern common to many of the DoD installations in the Chesapeake Bay study area, along with suggested recommendations to improve performance.

1. Long Term Monitoring Needs - It is believed that the control of toxics (and nutrients) from poorly defined point and nonpoint sources is the most important issue related to the preservation of local receiving water quality near military installations. Unfortunately, there are insufficient data to adequately quantify discharge characteristics, levels of impacts (if any) and required controls on such discharges. Because of this lack of information, a long-term monitoring program is recommended, where appropriate, for : 1) toxics in sewage or industrial waste treatment plant effluent; 2) toxics in intermittent stormwater drainage; and 3) field monitoring for conventionals and toxics

in the receiving water and sediments in the immediate vicinity of an installation. Each monitoring program should be designed according to the specific activities at a given installation. To aid in the design of these programs, a generic monitoring program, with sample cost estimates, is presented in Appendix A.

2. Nonpoint Source Runoff Control - In recent years water quality managers have become increasingly aware of the impacts associated with nonpoint source runoff. The EPA Chesapeake Bay Program has identified nonpoint source runoff as a major cause of water quality and resource habitat degradation in the Chesapeake Bay and its tributaries.

   This study has found evidence of nonpoint source contributions from military installations such as erosion, sediment runoff, and stormwater discharges. While a number of installations have begun actions to address these problems, their effectiveness in controlling nonpoint source runoff is uncertain. A systematic examination of sources of water quality impacts, on an installation-by-installation basis, would provide the necessary information to develop comprehensive action plans to reduce nonpoint source problems. Considerable expertise exists within the Services and agencies such as the Soil Conservation Service (SCS) to assist with nonpoint source evaluation and planning.

   A potential source of contamination to local receiving waters common to several installations involves the transport of contaminants in stormwater runoff from specialized military activities such as ordnance testing, open burning of chemicals, vehicle test track operations, and abandoned military hazardous waste disposal/spill sites. Little, if any, information exists either in the literature or at the installations to quantify the level of contaminants in surface water runoff associated with these special activities. A number of specific recommendations have been made to monitor contaminants in stormwater runoff (e.g., Dahlgren). Depending on results of data collection efforts, certain practices may require more careful controls or timing to avoid heavy rainfall events.

3. Hazardous/Toxic Materials - Over the past decade, the management of hazardous waste and toxic materials has increasingly come under public and regulatory scrutiny. In response to recently enacted regulations, hazardous waste management has become a very important part of any DoD installation's environmental program. The Resource Conservation and Recovery Act (RCRA) is the regulatory tool of the EPA to implement management requirements on generators of hazardous waste and operators of hazardous waste treatment, storage, and disposal (TSD) facilities. Because RCRA is largely not self-implementing, an installation must review the implementing regulations issued by the EPA. The EPA RCRA regulations are set forth in Title 40 of the Code of Federal Regulations, Parts 260-271 (technical and

permitting requirements) and Part 124 (administrative and hearing procedures). Installations are required to obtain a U.S. EPA Identification Number if they generate more than 100 kg/mo. In addition, RCRA requires every owner of a TSD facility to obtain a Part A and Part B permit. The treatment, storage, and/or disposal of the hazardous wastes is the responsibility of the installation generating the wastes. If the hazardous waste is removed from the generating installation, the Defense Logistics Agency (DLA) has primary responsibility. This is accomplished through the Defense Reutilization and Marketing Office (DRMO) and may involve a facility on the installation.

The accidental release of hazardous waste into the Chesapeake Bay or its tributaries could have a significant impact on the water quality and biological productivity of the receiving water. Implementation of and strict adherence to the management requirements of RCRA is necessary to insure minimal degradation of ecological resources of the Chesapeake Bay.

Provision of adequate storage space for hazardous waste in approved storage facilities helps to lessen the probability that the waste will accidentally enter receiving waters. Installations having approved Part A and Part B permits, conforming hazardous waste storage facilities (where required), as well as timely and efficient removal of the hazardous waste have a significantly lower potential for the accidental release of hazardous waste into receiving waters.

At the time of the installation visits, the hazardous material storage facilities were in compliance at most of the installations. Nonconforming storage facilities included those at NAS/NATC-Patuxent, DTNSRDC-Carderock, Andrews AFB, Norfolk Naval Shipyard and Fort Meade. Construction projects are planned to bring Fort Meade into compliance by FY89. Part B permits for DTNSRDC-Carderock and Andrews AFB have been submitted and are under review. Norfolk Naval Shipyard has a conforming storage facility, but it is full, resulting in storage of hazardous materials in other nonconforming areas. At NAS/NATC-Patuxent, a conforming storage area has recently been built and is awaiting final approval by the State of Maryland. Deficiencies in the temporary hazardous materials storage areas at Patuxent have been identified and require action. High priority should be given to bringing these and any other nonconforming storage facilities into compliance.

Several installations have experienced delays in the pick up of hazardous materials by the DLA disposal contractors. These include, but are not limited to, DTNSRDC-Carderock, HDL-Adelphi, Andrews AFB, Fort Meade, and Walter Reed Army Medical Center. The procedures for enforcing contract provisions should be improved to include contract authority at the point of material pick up. Flexibility and authority at the lowest level of DLA

contract implementation will provide the appropriate level of support needed by the Services.

In some cases, hazardous materials are stored in nonconforming areas because the capacity of the installation's existing storage area is being used to store waste materials which are to be sold by DLA. DLA has experienced difficulty finding buyers for certain types of waste materials, and these materials can take up needed storage space for the ongoing activities on the installation. The economic resale value of waste materials needs to be balanced against maintaining an adequate and safe storage capacity for ongoing installation activities.

The development of self-auditing programs and the RCRA compliance auditing program will furnish data on installation compliance and will identify problem areas needing immediate action. Phase III included a review of available RCRA compliance audits to help assess each installation's potential impact on the water quality and biological productivity of Chesapeake Bay.

4. <u>Sewage Treatment Systems</u> - Considerable progress has been made by DoD over the last several years in upgrading its sewage treatment plants and/or directing sewage to regional municipal systems for treatment. Continued improvements in NPDES permit compliance for existing wastewater treatment systems at DoD installations has been and continues to be aided by the provision of technical assistance, training seminars (refresher courses), and diagnostic evaluations to determine sources of system operational deficiencies. It is believed that operation and maintenance (O & M) training and operating assistance has the potential for improving discharge permit compliance, especially at small treatment plants. Official recognition and awards for exemplary and sustained compliance can also be used as an incentive to improve compliance.

5. <u>Installation Environmental Programs and Retention of Personnel</u> - The mission of an installation is its role in the national defense effort. Filling that role is the primary motivation in the way that the installation views its relationship to the surrounding community and environment. In some instances, the installation commander assigns a relatively low priority to environmental programs, and may not adequately address water quality or habitat considerations in performance of the installation's primary mission. This can affect environmental programs by limiting funding, staff support, and continuity. Lack of adequate support for environmental programs can lead to ineffective programs and to low staff morale.

At some installations, the effective implementation and continuity of environmental programs is hampered by the high turnover rate of installation environmental personnel. A number

of the installations visited had environmental coordinators who had been on the job for less than two years. The reasons for turnover are probably numerous but most often are related to promotion considerations or requested transfers. In some cases, a gap has existed between assignments of environmental coordinators, where ideally an overlap should occur to allow for proper transfer of information and training.

Enhancement of continuity could be achieved in a number of ways. The turnover rate could possibly be reduced by creating more opportunity for career and salary advancement in the environmental coordinator staff positions. If a high turnover is inevitable, continuity could be provided by the environmental engineering staff at the command level (e.g., NAVFAC divisions, AMC, TRADOC, etc.). To some extent this support is currently provided, but the regular demands on existing command level staff may prevent the day-to-day type of support and attention required on-site at an installation.

It is recommended that the Services and DoD continue to implement educational programs for installation administrative personnel (i.e., commanders and section chiefs and supervisors), where necessary, to clarify the relationship between sound environmental planning and the defense mission. Also, enhancement of the status and priority of environmental programs and continuation of appropriate staff training will probably contribute to staff satisfaction and continuity.

6. <u>Tenant Organizations and Security Considerations</u> - The relationship of the tenant organizations with the installation's environmental programs may require action. In certain instances the tenant organizations on an installation create water quality problems which are the responsibility of the host installation's environmental officer, but not under his or her direct control. Because avenues of approach often cross command, or even Service levels, these problems can be difficult to reconcile. In other cases, the environmental officer may not be fully aware of all activities taking place on the installation. One recommendation is to establish an environmental oversight committee which would consist of representatives from the tenant organizations. The committee would meet on a regular basis, review planned activities, and anticipate and reconcile any problems. This type of program has been implemented at Andrews AFB, for example, and has facilitated the environmental officer's task.

It is recognized that the security of an installation is of the utmost importance and that the missions of certain activities must, by necessity, remain out of the public domain. As such, the environmental coordinator on an installation may not be privy to the details of the operation of certain activities and may not be aware of existing or impending water quality problems. One unfortunate result is the perception, whether

justified or not, that these environmental problems are therefore not adequately addressed. Tighter management and control of tenant activities should be placed as a high priority by the installation environmental coordinator. It is strongly recommended that secure activities on an installation participate in establishing the above mentioned oversight group, and to cooperate, consistent with security concerns, in providing the environmental officer with information necessary to develop an effective water quality program. Secure tenants should also work within their own framework to insure their discharges and waste management activities are controlled. This can be facilitated by the activity training in-house environmental personnel, who have appropriate security access, to develop in-house programs consistent with the installation's overall environmental objectives.

7. <u>In-house Regulation</u> - During many installation visits it became apparent that there was a genuine belief on the part of the installation environmental coordinators that a good record of permit compliance was sufficient evidence of an installation's non-contribution to water quality problems. It is important to recognize that there is a current tendency by EPA and state agencies toward more stringent controls and monitoring of NPDES Permits to include priority pollutants and other toxic substances. Examples where this is currently affecting NPDES permit requirements include Fort Eustis, which has established an Effluent Toxics Monitoring Program in response to the VASWCB, and NOS-Indian Head, which is redesigning the industrial waste treatment system in conjunction with an upgraded NPDES permit. Good compliance with only conventional constituents often obscures contributions of other constituents in non-monitored areas on the installation.

It was discovered in examining the records and reports at most of the installations that monitoring of surface waters leaving the installation is normally minimal and therefore contributions to water quality in nearby streams or rivers cannot be readily quantified. Also, when programs are initiated which would result in water quality improvements, it becomes difficult to evaluate their effectiveness in the absence of appropriate monitoring. Few installations routinely monitor biota and sediments, which are generally recognized as the best "integrators" of certain water quality components, such as toxics. Regular and long term biota and sediment monitoring of the installation's surface waters can provide good indicators of water quality effects and periodic analyses of nutrient and toxics loadings can provide information as to the installation's contributions, as well as demonstrate the effectiveness of water quality improvement programs. Considerable expertise exists within the Services and Federal sector which can lend technical guidance to installations in the design of effective and efficient monitoring programs.

A number of preliminary recommendations related to improving DoD in-house regulation of environmental activities are listed below:

- o Review the procedures used by DRMO's to contract out removal of hazardous waste from DoD installations. A common problem at installations is the lack of prompt removal of hazardous wastes within the 90 day limit under the RCRA requirements.

- o Review and enhance, if necessary, existing training and education programs on environmental regulations and compliance requirements for environmental personnel at both the installation level and at command and Service levels.

- o Create a more authoritative and more visible in-house environmental regulation function at the DoD Service levels ("from the top down"). This appears to be needed since response to changes in the regulations is sometimes slow by the installations/MACOMS, and a certain amount of friction exists with regulatory agencies in dealing with specific issues. The demonstration by DoD of more effective self-regulation should improve DoD's relationship with EPA and the states, as well as with the public.

- o Improved information transfer between installations and MACOMS/Services, as well as between DoD and the regulatory agencies would greatly benefit the transfer of technology and help short-circuit potential compliance problems.

- o Many of the recommendations identified in Phase II involve complex technical issues that may require special expertise to address. It is believed that technical assistance from several outside group/agencies should be tapped by DoD to develop and implement, for example, effluent and receiving water monitoring programs (AEHA, NEESA, OEHL, EPA, States), stormwater management plans and soil conservation programs (Federal and State soil conservation services, EPA), and natural resources plans (Fish and Wildlife, EPA, States). Consideration should also be given to developing a series of generic guidance documents (e.g., stormwater management, point and nonpoint source monitoring programs) which can be used by DoD personnel to develop, update and implement installation environmental management programs.

8. <u>DoD's Role in the Chesapeake Bay Restoration and Protection Plan</u> - The foundation of this study is the Joint Resolution signed by DoD and EPA in 1984 which officially involved DoD in the Chesapeake Bay Restoration and Protection Plan. The

installation evaluations and recommendations developed under this study are fashioned after the goals and objectives identified by the EPA and the States of Maryland and Virginia (EPA, 1984). The Executive Summary of the Plan is reprinted in Appendix B. There is a continuing need for DoD, EPA and the states to cooperate in developing and implementing specific programs to meet the objectives of the Plan. The following lists a number of suggested recommendations for consideration:

- o With the assistance of EPA and the States, coordinate DoD's data collection/monitoring programs with EPA/State data collection programs to maximize continuity and efficiency. A coordinated monitoring plan would offer significant benefits to each program in terms of funding, time, and creation of a more useable data base.

- o It would be advantageous for all monitoring data collected by DoD to be incorporated into a data base format compatible with the EPA Chesapeake Bay data base, as described by SCI (1986).

- o The action plan developed by the Chesapeake Bay Restoration and Protection Plan should be used as a guide to develop DoD's environmental programs in the Chesapeake Bay region. The installation - specific recommendations developed during this study are based on these action plans.

- o It is recommended that DoD consider offering certain installation environmental projects as demonstration or pilot projects for the EPA and State programs. Such projects could involve testing of stormwater runoff control devices/plans, shoreline erosion control devices, agricultural practices on outlease areas, or effluent toxics monitoring programs. A dual benefit from such cooperative efforts would be improvement in DoD's environmental management capability while also fostering improved public relations and interagency relations.

9. <u>Recommendations Directed at the EPA/State Agency Levels</u> - It is important to note that most environmental problems at DoD installations are not unique. Private industry, agricultural activities, and the municipal infrastructure experience the same type of problems and are the dominant contributors of pollutants to the Bay. In fact, DoD has performed remarkably well in responding to environmental regulations, especially regarding the direct discharge of effluent from sewage treatment plants. However, regulations are being constantly upgraded, and many areas of environmental concern are not adequately addressed by current regulations (e.g., nonpoint sources). It is believed that the regulatory agencies need to work more effectively with the military, especially in providing guidance on new

developments in the regulations and in areas identified as concerns for the Chesapeake Bay Restoration and Protection Plan, i.e., nonpoint source control, elimination of industrial discharges to storm sewers, control of toxics in sewage effluent, and wetlands restoration and protection.

An advantage that the military has that is unique compared to private industry, agriculture, and the municipal infrastructure throughout the Chesapeake Bay region is the ability to develop, direct and control a program uniformly throughout the DoD services when initiated from the top down. This capability can be utilized efficiently by DoD to implement new directives in the regulations.

One particular recommendation aimed at the EPA and the states is the need to automate the DMR (Discharge Monitoring Report) data on the PCS (Permit Compliance System) data base. It was discovered during this study that the PCS system was missing most of the DMR data, especially for installations in the States of Maryland and Virginia. DMR data for the State of Pennsylvania were, however, up-to-date. The evaluation of sewage treatment discharge compliance, and determination of effluent characteristics would be significantly enhanced with an automated DMR data base system.

6.4 EVALUATION OF THE INSTALLATION ASSESSMENT METHODOLOGY

Presented below is a summary of the major strengths of the assessment methodology.

1. The methodology has provided a structured, orderly process in which a large amount of information was processed in a relatively short time.

2. Due to its structure, the methodology evaluated all installations on a common basis. This allowed a comparison to be made of common problem areas, beneficial effects, and study recommendations.

3. The methodology helped identify problem areas on installations and provided specific recommendations that could be used for program or project planning.

4. The methodology provided a "new" perspective of an installation's activities, relative to its surrounding activities and environment. Also, the use of vicinity data and information (where available) could be used to verify data or findings produced by the installation.

5. The Phase II and III analyses provided a check of the data and information used to screen the installations in Phase I. The

updated screening results are considered a more accurate representation of each installation's impact potential.

6. The methodology is general and flexible enough so that it could be used by DoD to evaluate other regional DoD activities. Key examples include San Francisco Bay and the Puget Sound area, both of which host extensive military activities, and are key estuary systems under study by the EPA and the respective state agencies.

The following lists what are believed to be the major limitations of the assessment methodology:

1. The methodology is totally dependent upon available information and data. No field data have been collected as part of this study. It is rare that the existing historical data base includes appropriate constituents as well as the spatial and temporal coverage to adequately define or verify a suspected cause and effect relationship between an installation pollutant source and local water quality concerns. This is especially the case for sediment quality and benthic biological species data, which are most valuable for representation of the cumulative impacts of low concentration toxic discharges.

2. The estimation of the nonpoint source loadings of conventional pollutants (BOD, nutrients, sediments) and nonconventional pollutants (metals) has been a useful exercise in the test cases, in showing that the relative installation nonpoint source contributions can be just as accurately estimated simply by using the ratio of the installation's land surface area to the total tributary drainage area. The estimation procedures, however, do not allow accurate quantification of toxics (hydrocarbons, trace organics, metals) from the highly specialized military activities.

3. In the absence of appropriate historical water quality data, the methodology is not capable of making accurate predictions of concentrations of pollutants in receiving waters or sediments. Therefore, it is difficult to make quantitative judgements about the actual impact level for any particular pollutant discharge. Accurate predictions of water quality concentrations require sophisticated modeling techniques and reliable pollutant source loadings data. Neither of these are obtainable within the scope of this investigation. Due to the difficulty of quantifying water quality impacts, 16 of the installations analyzed in Phase III remained in Study Group 2 (poorly defined but likely significant impacts), and 21 remained in Study Group 3 (poorly defined but likely insignificant impacts).

4. In the process of reviewing information from the various installations and MACOMS, it became apparent that key information was sometimes not identified or received.

Successive and repeated inquiries usually led to the discovery of new data or information helpful in assessing water quality impacts. The difficulty in obtaining information varied between installations and between MACOMS. It is felt that, in many instances, additional information probably exists but is still unknown to this study effort, despite extensive efforts to obtain all pertinent data, studies and reports.

Presented below are a list of recommendations aimed at improving the study effort.

1. Prepare "Guidance models" for the recommended actions or programs/practices at DoD installations. Examples include effluent toxics monitoring plans, stormwater management plans, soil conservation plans, wetlands management plans, and point and nonpoint source field monitoring programs. Also it is recommended that cost guidelines be prepared for estimating the implementation cost of various environmental programs. Where possible, the guidance models would be based on examples taken directly from DoD installations in the study region, e.g., the Fort Eustis Toxics Monitoring Program.

2. Update the installation screening procedure periodically as new projects, practices, and data develop at DoD installations. This update can be used as a measure of progress for DoD's role in the Chesapeake Bay Restoration and Protection Plan, and to help redefine priorities, if necessary, for focusing resources in key problem areas.

3. Consider selecting one or more "control" installations for detailed evaluation. This would include, but not be limited to, collecting field data to better quantify pollutant loadings and receiving water conditions. The control installation(s) would serve as a benchmark to judge the validity and accuracy of the installation assessments performed as part of this study.

4. It is recommended that the bibliographic data base developed during this study be programmed for better sorting capability and should also be updated annually to ensure that current literature is accessible for review. There currently exists approximately 800 documents on this database.

5. Consideration should be given to adding risk assessment to the methodology to evaluate potential water quality and living resources impacts from hazardous waste spills/accidents, oil spills, catastrophic events, and general single event occurrences. Associated with this assessment would be an in-depth review of SPCC plans, hazardous waste management plans, biocides application guidelines, etc., as well as an evaluation of past spill/accident history at each installation.

APPENDIX A

A GUIDANCE DOCUMENT FOR
DEVELOPING THE FRAMEWORK
FOR WATER QUALITY SAMPLING
PROGRAMS AT DOD INSTALLATIONS
(LEVEL 1 - SCREENING)

TABLE OF CONTENTS

CHAPTER 1. OVERVIEW

INTRODUCTION

A major finding of the water quality study of DoD installations in the Chesapeake Bay Region (Tetra Tech, 1987a,b) is the general lack of information to adequately characterize local water quality conditions at installations where areas of concern have been identified. For these installations, a monitoring program has typically been recommended for one or all of the following: 1) toxics (heavy metals, trace organics, priority pollutants) in sewage or industrial waste treatment plant effluent; 2) toxics in intermittent stormwater drainage; and 3) field monitoring for conventionals and toxics in the receiving water and sediments in the immediate vicinity of the installation. Each monitoring program should be designed according to the specific activities at each installation. Although monitoring for toxics is not currently required, recent experience suggests that NPDES permit requirements will be upgraded by the EPA to include monitoring for toxic pollutants. At Fort Eustis, for example, a Toxics Monitoring Program was recently instituted to determine the need for pretreatment and/or elimination of several minor industrial waste processes discharging to the on-post sewage treatment system. At NOS Indian Head, a major feasibility study is underway to design a series of industrial waste treatment systems to consolidate and treat approximately 48 intermittent industrial discharges/combined storm drains in anticipation of a revised NPDES permit to control and monitor toxic pollutants. As a way of anticipating changes to the regulatory requirements regarding toxics, it is in the best interest of DoD to conduct a certain level of "self-monitoring" in order to plan appropriately, as well as to isolate the effects of military activities from upstream (riverine) or nearby (estuarine) pollutant sources. Self monitoring activities are performed at a number of installations, including Aberdeen Proving Grounds, Andrews Air Force Base, and Langley Air Force Base.

This report presents general guidance for use by DoD installation personnel to develop the framework for a site-specific water quality sampling program suitable for a specific installation. As shown in Figure 1, the overall monitoring program can consist of three phases, or levels. In Level 1, preliminary screening of the various discharges (point and nonpoint) is conducted to determine whether contaminants of concern are being discharged or if the receiving environment in the vicinity of a discharge has been negatively impacted. If it is established that further study is required to determine the extent of impact or the nature of sources, then Level 2 sampling would commence which incorporates additional sampling of the receiving environment and discharges. Source identification and evaluation is a further goal of Level 2. In many cases the Level 2 analysis may indicate that observed contamination in the receiving environment is a result of non-DoD discharges located upstream or adjacent to the DoD installation. If not, then Level 3 would be initiated to evaluate and perform source control measures. Source control measures include actions

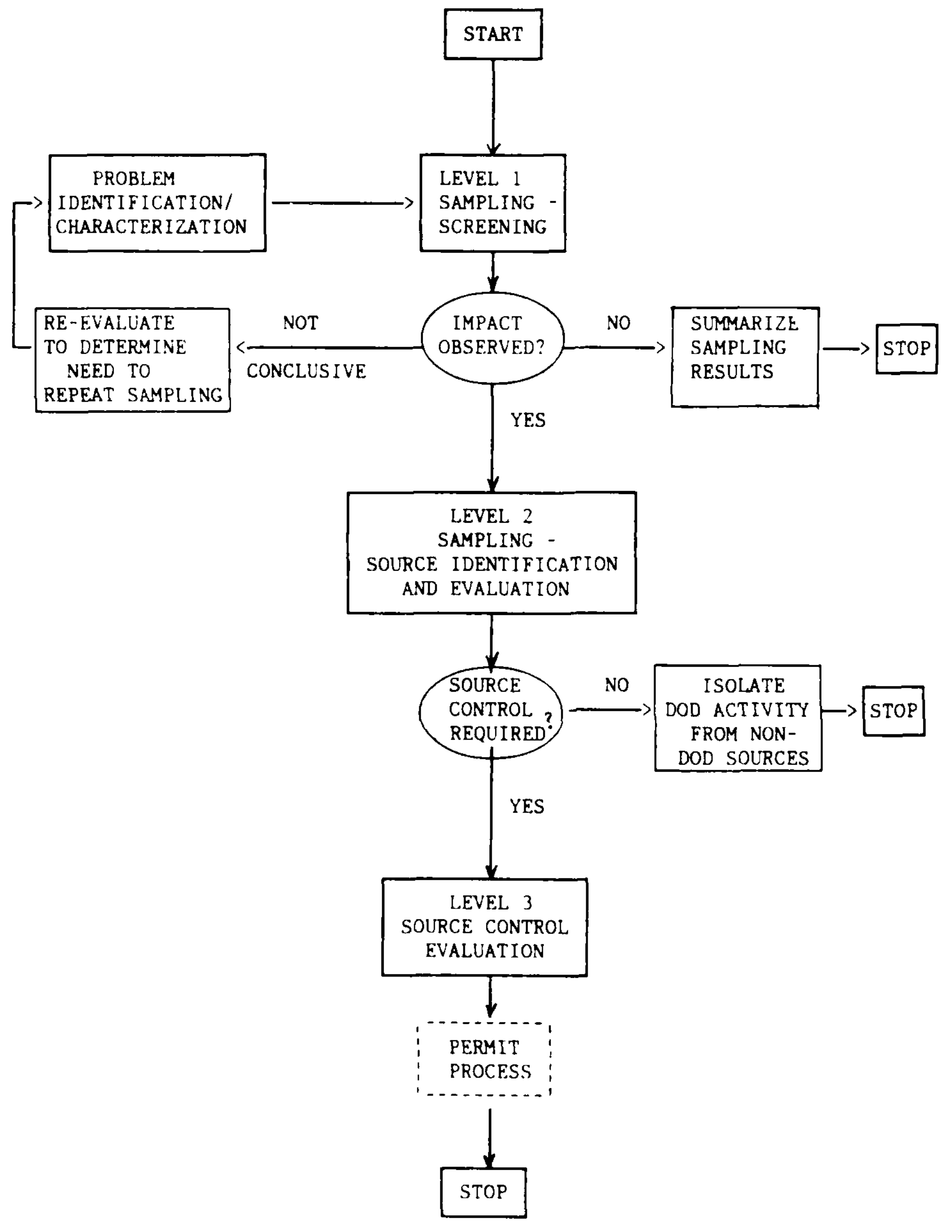


Figure 1. Monitoring Program Approach for DoD Installations

taken to keep the contaminants of concern from reaching Chesapeake Bay or its tributaries and actions taken to clean up the contaminant reservoirs. These actions may include the development of a new or upgraded NPDES permit, for example.

A hypothetical example which illustrates the above process is described as follows. A storm drain at a DoD installation is suspected of introducing pollutants to a stream due to known industrial activities draining into the storm sewer system or a poorly defined drainage network in an older area of the installation. Level 1 sampling is performed in the stream above and below the storm drain and the collected water and sediment samples indicate moderately high levels of an organic solvent. Sediments in the storm drain are also sampled and indicate presence of high levels of the organic solvent. At this point Level 2 sampling is recommended. Under Level 2, a program of sampling at successive upstream junctions in the storm drain system would be implemented to attempt to locate the branch of the storm drain system that is discharging the contaminant to the system. An analysis of potential sources of the contaminant in the drainage area identified through sampling (possibly including site inspections) would then be performed to identify the source of the contaminant. A subsequent source evaluation would entail determination of the size of the contaminant reservoir, determination of how the contaminant gets into the storm drain system, and, possibly, chemical characterization of the source to determine the form of the contaminant and the presence of other contaminants. In this case, the source turns out to be a floor drain in a vehicle maintenance area which is improperly connected into the storm drainage system. Under Level 3 activity the floor drain is rerouted to an oil water separator and the solvent application is performed using stricter controls.

Using the same scenario above, the Level 1 sampling alternatively might have shown that the organic solvent concentrations were higher in the stream sediments upstream of the suspected storm drain outfall, thus implicating another source, possibly beyond the boundaries of the DoD installation.

Although many of the DoD installations experience similar potential contaminant problems, the individual sources responsible for the problem will be distinctly different at each installation. This guidance document focuses primarily on Level 1 sampling activities. Level 1 or screening sampling is more readily generalized since the sampling focuses on the receiving waters rather than on the specific source characteristics. Even so, the recommendations and guidelines included in this document will have to be modified to take into account site specific conditions at each DoD installation. Because of the wide variety of individual source characteristics expected to exist, no detailed guidelines are included in this document for Level 2 or Level 3 activities. DoD installation personnel are expected to consult with appropriate expertise to design and execute an appropriate source control program, as well as to prepare the final detailed plans for the Level 1 sampling program.

Major constraints on any monitoring program developed under this guidance are that sampling analysis should address the goals of the DoD initiative for Chesapeake Bay and that it should also be sufficient for assessing compliance with applicable Federal, state, and local water quality regulations. Further, the monitoring program focuses on water quality and does not deal with biological sampling. Biological sampling is a complex subject outside the scope of this document.

USING THE GUIDANCE DOCUMENT

This guidance document is intended to assist DoD installation personnel in preparing a general framework for a water quality monitoring program to identify contamination problems and, if necessary, control pollutant sources on DoD installations. Details for preparing site-specific field sampling and laboratory protocols, schedules, QA/QC procedures, and laboratory and field costs are beyond the scope of this document. Rather, it is expected that installation personnel, if necessary, will consult with the appropriate expertise to develop detailed procedures.

The steps necessary to develop the framework for an installation monitoring program are shown in Figure 2. In Step 1, a determination is made, based on existing knowledge of the discharges and receiving waters on an installation, as to which type of discharge is of concern. The types of discharges include point sources, nonpoint sources, groundwater, and other unique discharges (i.e., ship refueling, dry docks, contaminated sediment deposits, etc). This document is divided similarly. Steps 2 through 4 (i.e., preliminary site investigation, Level 1 receiving waters sampling design, and Level 1 discharge sampling design) are addressed for each type of discharge under the appropriate chapter. Step 5 (decision for Level 2 analysis) is discussed in Chapter 6. Step 6 (Level 2 analysis) is briefly discussed under the appropriate chapter by discharge type but detailed guidance is beyond the scope of this document.

It is important to note that, for a given site-specific situation, a combination of different types of discharges may exist on the same stream or water body. In this situation, a monitoring program should be designed to integrate the requirements of separate discharges and avoid unnecessary sampling repetition or overlap. Development of an integrated monitoring program can be a complex undertaking and it is expected that DoD installation personnel will consult with appropriate expertise to design the program. It is also worth noting that other ongoing programs on DoD installations (i.e. NPDES, IRP) may involve periodic or one time sampling of parameters and locations similar to those described in this document. This document is not intended to serve as a replacement for the monitoring guidance given by other programs, but rather should be used to supplement and, if possible, enhance the overall ability of the DoD installations to identify and control pollutant sources.

STEP 1 - Identification of Areas of Concern (Source Type)	⟶	Point Source (CHAPTER 2) Nonpoint Source (CHAPTER 3) Groundwater Source (CHAPTER 4) Other Discharges (CHAPTER 5)
STEP 2 - Preliminary Site Investigation	⟶	Discharge Locations Waste Characteristics Hydrologic Characteristics Historical Data Review
STEP 3 - Level 1 Receiving Waters Sampling Design	⟶	Station Locations Sampling Parameters Frequency of Sampling Sampling Methods
STEP 4 - Level 1 Discharge Sampling Design	⟶	Sampling Parameters Sampling Methods Freguency of Sampling
STEP 5 - Decision For Level 2 Analysis	⟶	Evaluation of Level 1 Sampling Data
STEP 6 - Level 2 Analysis	⟶	(Detailed Guidance Beyond Scope of This Document)

Figure 2. Steps Necessary to Develop Framework for Monitoring Program

STEP 1 - IDENTIFICATION OF AREAS OF CONCERN

Because the monitoring framework presented in this report is general in nature, it must be modified for each installation by incorporating site-specific information. A first step in customizing the generic monitoring framework is to identify known problems and key discharge points, and review information on the history of waste disposal practices and operations at the installation. The following is a list of some of the types of information needed:

- Locations of all discharges to surface waters
- Correct, up-to-date maps of sewer and storm drain systems
- Maps of drainage areas for the various storm drains
- Any available information on flow rates of the various discharges
- List of any industries, operations, and other contributors of wastewater to the wastewater treatment plant(s), including their locations and information regarding any known contaminants in their wastewaters
- Compilation of information from any studies performed at the installation relating to contaminants present, concentrations in various wastestreams, and identified sources
- Site map showing locations of all buildings, roads, waste storage or containment areas, operations facilities (e.g. vehicle refueling), stored and buried wastes
- Any other information regarding locations of potential sources of contaminants.

Much of this information has been collected and summarized in the water quality study of DoD Installations in the Chesapeake Bay Region (Tetra Tech, 1987 a,b). Recommendations for specific monitoring activities were made in these documents. Other more recent or more site-specific information should also be taken into consideration.

The goal of Step 1 is to identify and prioritize known or suspected areas of concern regarding the discharge of conventional and toxic pollutants to local surface waters (or to groundwaters in close proximity to surface waters). Once a particular discharge or group of discharges has been identified, information in the remaining chapters of this document can be used to develop a general framework for a site-specific monitoring program.

At this point, the user is referred to a specific chapter depending on the type of pollutant source of concern (See Figure 2).

CHAPTER 2. POINT SOURCE MONITORING

INTRODUCTION

The primary point sources of interest are most likely outfalls discharging effluents from sanitary wastewater treatment plants (WWTPs), industrial WWTPs, WWTPs treating mixed industrial and sanitary waste, and partially treated or untreated industrial wastes (including wastes discharged to storm drains). Examples of partially treated or untreated industrial waste include oil/water separators, building drains, and vehicle wash racks. As used below, the term "combined storm drains" refers to storm drains that have industrial wastewater inputs.

All point sources discharging directly to surface waters are required to have a NPDES permit, which includes periodic monitoring of the quantity and quality of the discharge. The NPDES monitoring requirements may or may not provide sufficient information to determine point source discharge impacts, depending on the degree of likelihood of the presence of nonconventional pollutants (toxics) that may be present in the discharge. Most NPDES permits do not address toxics. Thus, the emphasis on sampling and analysis of point source discharges is on toxics.

SAMPLING DESIGN

Step 2 - Preliminary Site Investigation

Specific site characteristics must be identified in order to properly design a monitoring program. Required information includes the locations of all point discharges and characteristics of those discharges, including flow rates (average, daily, and seasonal) and substances potentially in the discharge. The locations of wastewater treatment plants and the treatment processes used at those plants are important to enable an estimate to be made of the discharge characteristics. Much information about point sources requiring discharge permits can be obtained from National Pollutant Discharge Elimination System (NPDES) Discharge Monitoring Reports (DMRs).

Step 3 - Level 1 Sampling Design for Receiving Waters

The receiving environment for a point discharge from a DOD facility is typically a river or stream, or a confined area within an estuary.

Estuary Sampling Scheme --

For those areas such as estuaries that have poorly characterized current regimes, water column sampling may not be warranted. In many cases, high initial dilution of the wastewater plume will result in very low water column concentrations of contaminants and concomitant problems with concentrations that are too low for reasonably achievable detection limits. In such cases, sediments rather than the water column should be sampled.

Sediments are a natural sink for many contaminants, and analysis of sediments can reveal considerable information concerning past inputs of contaminants. Concentrations of contaminants in the sediments can be used to identify problem outfalls, and, by sampling in a line away from an outfall, a gradient in concentration can often be seen. These gradients help to delineate the extent of the contamination problem and provide more conclusive proof of the identity of a problem source. For open-pipe outfalls, at least two or more sediment cores should be collected in line with the outfall and extending offshore (Figure 3). Sampling locations can be modified on the basis of known current characteristics. Although most of the outfalls from the facilities are open-pipe, there may be some that have diffusers attached to the outfall terminus, the purpose of which is to cause better initial dilution of the effluent plume. For the cases in which diffusers are present, modifications to the sampling scheme will be necessary and must be based on site-specific information as to current regimes, effluent flow rates, and discharge depth.

It is recommended that surface sediments (the top 2 cm) be sampled and analyzed for the variables listed below. Sediments should be analyzed for priority pollutant metals and other metals: antimony, arsenic, beryllium, cadmium, chromium, copper, cyanide, lead, mercury, nickel, silver, thallium, and zinc. Measurements of total organic carbon, total volatile solids, and grain size should be performed for all sediment samples. In cases where it is suspected that priority pollutant organic compounds are present, priority pollutant analyses should be conducted.

Rivers and Streams Sampling Scheme --

For rivers and other areas for which the current flow direction is consistent and known, the water column should be sampled upstream and downstream of the discharge point to attempt to establish changes in the stream water quality resulting from the discharge (Figure 3). Sampling upstream should be conducted far enough from the discharge point to preclude influence from the discharge. Sampling downstream should be conducted at a place after the discharge has mixed completely with the receiving water. Sampling should ideally be performed under summer (high temperature - low flow conditions) as well as under different seasonal conditions (Fall or Spring). Visual observations of conditions such as surface slicks, water discoloration, and foaming should be recorded. Recommended sample sizes, containers, preservation, holding times, and analytical methods can be found in Tables 1 and 2.

For river water quality monitoring, it is recommended that the following variables be measured: temperature, salinity, pH, and concentrations of dissolved oxygen, total organic carbon, total suspended solids, grease and oil, total Kjeldahl nitrogen, ammonia nitrogen, nitrate + nitrite nitrogen, total phosphorus, and any chemical compounds unique to the facility, such as munitions compounds. Depending on local water quality regulations, turbidity and concentrations of coliform bacteria may need to be measured. In addition to any other times of the year that the receiving environment is sampled, the dissolved oxygen concentrations should be measured in the

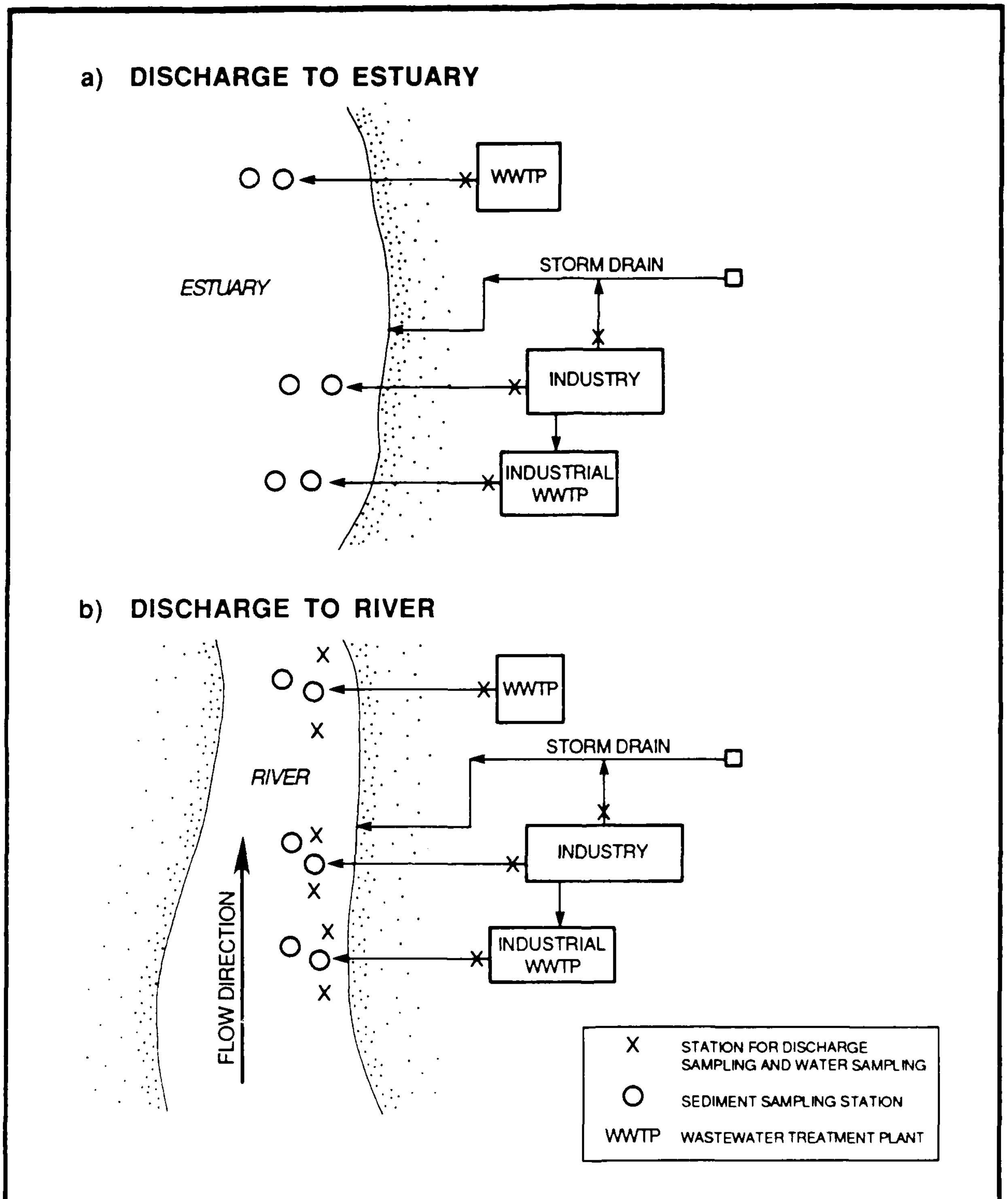


Figure 3. Example locations of sampling stations for sampling point sources.

TABLE 1 RECOMMENDED SAMPLE SIZES, CONTAINERS, PRESERVATION, AND HOLDING TIMES FOR OFFSHORE SAMPLES

Measurement	Minimum Sample Size[a]	Container[b]	Preservative	Maximum Holding Time
Receiving water[c]				
pH	25 mL	P,G	None	Analyze immediately[d]
Salinity	200 mL	P,G	None	Indefinite
Temperature	1 L	P,G	None	Measure immediately[d]
Color	50 mL	P,G	Cool, 4°C	48 h
Turbidity	100 mL	P,G,	Cool, 4°C	48 h
Total suspended solids	1-4 L[e]	P,G	Cool, 4°C	7 days
Settleable solids	1 L	P,G	Cool, 4°C	48 h
Floating particulates	5 L	P,G	None	Analyze immediately[d,f]
Dissolved oxygen				
Probe	300 mL	G bottle & top only	None	Analyze immediately[d]
Winkler	300 mL	G bottle & top only	Fix on site; store in dark	8 h
Biochemical oxygen demand	1,000	P,G	Cool, 4°C	48 h
Oil and grease	1,000	G only	Cool, 4°C H_2SO_4 to pH<2	28 days
Nitrogen				
Ammonia-N	400 mL	P,G	Cool, 4°C H_2SO_4 to pH<2	28 days
Total Kjeldahl-N	500 mL	P,G	Cool, 4°C H_2SO_4 to pH<2	28 days
Nitrate + Nitrite-N	100 mL	P,G	Cool, 4°C H_2SO_4 to pH<2	28 days
Phosphorus (total)	50 mL	P,G	Cool, 4°C H_2SO_4 to pH<2	28 days
Total and fecal coliform bacteria	250-500 mL	P,G	Cool, 4° C 0.008% $Na_2S_2O_3$[g]	6 h
Enterococcus bacteria	250-500 mL	P,G	Cool, 4° C 0.008% $Na_2S_2O_3$[g]	6 h[h]
Chlorophyll a	2-4 L[e]	P,G	Freeze at -20° in the dark in a desiccator	21 days[i]
Phytoplankton	1 L	P,G	10% formalin	Indefinite[h]

EPA (1987)

TABLE 1 (Continued)

Sediment/infauna				
Grain size	100 g	P,G	Cool, 4° C	6 mo[h]
Total solids	50 g	P,G	Freeze	6 mo[h]
Total volatile solids	50 g	P,G	Freeze	6 mo[h]
Total organic carbon	50 g	P,G	Freeze	6 mo[h]
Biochemical oxygen demand	50 g	P,G	Cool, 4° C	7 days
Chemical oxygen demand	25 g	P,G	Cool, 4° C	7 days
Oil and grease	50 g	G only	Cool 4° C; or freeze	28 days[h]; 6 mo[h]
Sulfides				
Total	50 g	P,G	Cool, 4° C zinc acetate	7 days[h]
Water soluble	10 g	P,G	Cool, 4° C SAOB	4 days[h]
Priority pollutant metals	50 g	P,G	Freeze	6 mo[h]
Priority pollutant organic compounds				
Extractable compounds	100 g	G only	Freeze	6 mo[h]
Purgeable compounds	40 mL[j]	G only	Cool, 4° C	14 days[h]
Infauna	1 grab sample	P,G	10% formalin, then transfer to 70% ethanol or isopropyl alcohol	7 days[h] in formalin; indefinite in alcohol
Bioaccumulation (tissue)				
Priority pollutant metals	10 g	P,G[k]	Freeze	6 mo[h]
Priority pollutant organic compounds	50 g	G only[k]	Freeze	6 mo[h]

[a] Recommended field sample sizes for one laboratory analysis. If additional laboratory analyses are required (e.g., replicates), the field sample size should be adjusted accordingly.

[b] Polyethylene (P) or Glass (G).

[c] Reference: Adapted from U.S. EPA (1979b, 1984).

[d] Immediately means as soon as possible after the sample is collected, generally within 15 min (U.S. EPA 1984).

[e] Depends on concentration.

[f] No recommended holding time is given by U.S. EPA for floating particulates. Analysis should therefore be made as soon as possible.

[g] Should only be used in the presence of chlorine residual.

[h] This is a suggested holding time. No U.S. EPA criteria exist for the preservation of this variable.

[i] Strickland and Parsons (1977) recommend several weeks.

[j] Sediment sample should completely fill the 40-mL VOA vial (see text for details).

[k] These containers are for the tissue after resection. Whole organisms (e.g., fish) may be stored in aluminum foil for transfer to the laboratory for resection.

TABLE 2 RECOMMENDED METHODS FOR MEASURING RECEIVING-ENVIRONMENT VARIABLES

Variable	Method Reference U.S. EPA[a]	APHA[b]	Other[c]
Receiving Water			
pH	150.1	423	*In situ*[d]
Salinity	-	-	Salinometer[e] *In situ*[d]
Temperature	170.1	212	*In situ*[d]
Color	110.3	204B	-
Turbidity	180.1	214A	-
Transmissivity	-	-	*In situ*[d]
Total suspended solids	160.2[f]	209C[f]	-
Settleable solids	160.5	209E	-
Floating particulates	-	206A[g]	-
Dissolved oxygen			
Probe	360.1	421F	*In situ*[d]
Winkler	-	-	Strickland and Parsons (1972)
Biochemical oxygen demand	405.1	507	-
Oil and grease	413.1 413.2	503A 503B	-
Nitrogen			
Ammonia-N	350.1 350.2 350.3	417A 417B 417D 417G	*In situ*[d]
Total Kjeldahl-N	351.1 351.3	417B 417D 417E 420A 420B	-

EPA (1987)

TABLE 2 (Continued)

Nitrate+nitrite-N	353.2 353.3	418C 418F	-
Phosphorus (total)	365.1 365.2 365.3	424C 424F 424G	-
Total coliform bacteria	-	908A[h] 909A[i]	p. 114[h,j] p. 108[i,j]
Fecal coliform bacteria	-	908C[h] 909C[i]	p. 132[h,j] p. 124[i,j]
Enterococcus bacteria	-	-	U.S. EPA[k]
Chlorophyll *a*	-	-	Strickland and Parsons (1972)
Phytoplankton	-	-	Stofan and Grant (1978)
Sediment			
Grain size	-	-	Plumb (1981)
Total solids	-	-	Plumb (1981)
Total volatile solids	-	-	Plumb (1981)
Total organic carbon	-	-	Plumb (1981)
Biochemical oxygen demand	-	-	Plumb (1981)
Chemical oxygen demand	-	-	Plumb (1981)
Oil and grease	-	-	Plumb (1981)
Sulfides			
Total	-	-	Plumb (1981)
Water soluble	-	-	Green and Schnitker (1974)

TABLE 2 (Continued)

Priority pollutant metals	-	-	Tetra Tech (1986a)
Priority pollutant organic compounds	-	-	Tetra Tech (1986a)
Infauna	-	-	Present document
<u>Bioaccumulation (tissue)</u>			
Priority pollutant metals	-	-	Tetra Tech (1986b)
Priority pollutant organic compounds	-	-	Tetra Tech (1986b)

[a] Methods recommended in U.S. EPA (1979b).

[b] Methods recommended in APHA (1985).

[c] Methods recommended in sources other than U.S. EPA (1979b) or APHA (1985) when no methods were recommended in the latter two sources.

[d] This variable can be measured using an *in situ* instrument. The operating manual for the instrument should provide all necessary information for proper instrument calibration and measurement of this variable.

[e] The instruction manual for the salinometer should provide all necessary information for instrument calibration and salinity determination.

[f] A 0.40- or 0.45-um membrane filter should be used instead of the glass-fiber filter recommended in the method.

[g] This method is tentatively recommended by APHA.

[h] This method can be used whether or not chlorine is present.

[i] This method can be used only when chlorine is absent.

[j] Page reference of this method in Bordner et al. (1978).

[k] U.S. EPA is currently finalizing a recommended method for this variable.

summer, when the dissolved oxygen concentration is normally at its lowest because of reduced solubility at higher temperatures.

Sediment sampling in rivers is recommended only for those cases in which the receiving environment in the immediate vicinity of the discharge is a depositional environment. If the river is swift at the point of discharge, then it is unlikely that solids from the discharge will settle close to the discharge point, therefore reducing the probability that elevated concentrations of contaminants will be found there. Also, under such conditions, there will probably not be a sufficiently clear gradient of pollutant concentrations in the sediments with which to determine the degree to which the discharge may be the source of the pollutants.

STEP 4 - LEVEL 1 Sampling Design for Discharges

Discharge Parameters of Interest --

Consistent with findings from the EPA Chesapeake Bay Program, the contaminants of primary interest are heavy metals (see Table 3), toxic chemicals, priority pollutants, and nutrients. "Conventional" pollutants (biochemical oxygen demand, total suspended solids, and grease and oil) should also be measured. For effluent monitoring, it is recommended to measure the following variables: flow rate, temperature, 5-day biochemical oxygen demand (BOD), total suspended solids, total organic carbon, grease and oil, pH, dissolved oxygen, and nutrients (nitrate + nitrite, total Kjeldahl nitrogen, ammonia, and total phosphorus. Measurements of turbidity or coliform bacteria may be necessary, depending on local water quality regulations. For cases in which it is suspected that priority pollutants, heavy metals, or compounds associated with munitions or other military operations may occur in the effluent, those contaminants should be measured.

Sampling Methods --

Sampling methods should follow standard protocols. Detailed protocols can be found in documents such as Tetra Tech (1985), U.S. Environmental Protection Agency (1987), and U.S. Geological Survey (1977). Several example protocols can be found in Attachment 1. Because protocols can vary slightly from agency to agency and study to study, prior to initiation of the monitoring program, agreement with the appropriate authorities on sampling and analysis protocols should be obtained in order to secure acceptability of any data obtained. Acceptable quality assurance/quality control (QA/QC) procedures (i.e. as in US EPA, 1987) should be followed in all monitoring program activities.

It is recommended that analyses of priority pollutants, metals, and munitions-type compounds be run both on a bulk sample and on the particulate fraction. The dissolved fraction can be calculated by difference. Analyses of the bulk effluent yield information on the characteristics of the total effluent. Because many metals and other pollutants are often associated with particulates, important information concerning their potential effects on the environment and concerning potential methods for decreasing their

TABLE 3 The Expanded List of the 126 Priority Pollutants (Ref: 40 CFR 125.58)

METALS AND OTHER INORGANICS

Antimony
Arsenic
Asbestos
Beryllium
Cadmium
Chromium
Copper
Cyanide
Lead
Mercury
Nickel
Selenium
Silver
Thallium
Zinc

PESTICIDES

Acrolein
Aldrin
Chlordane
DDD
DDE
DDT
Dieldrin
Endosulfan and Endosulfan Sulfate
Endrin and Endrin Aldehyde
Heptachlor
Heptachlor Epoxide
Hexachlorocyclohexane (α, β, δ isomers)
τ-Hexachlorocyclohexane (Lindane)
Isophorone
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCCD)
Toxaphene

TABLE 3 (continued)

HALOGENATED ALIPHATIC HYDROCARBONS

Chloromethane (Methyl Chloride)
Dichloromethane (Methylene Chloride)
Trichloromethane (Chloroform)
Tetrachloromethane (Carbon Tetrachloride)
Chloroethane (Ethyl Chloride)
1,1-Dichloroethane (Ethylidine Chloride)
1,2-Dichloroethane (Ethylene Dichloride)
1,1,1-Trichloroethane (Methyl Chloroform)
1,1,2-Trichloroethane
1,1,2,2-Tetrachloroethane
Hexachloroethane
Chloroethene (Vinyl Chloride)
1,1-Dichloroethene
1,2-trans-Dichloroethene
Trichloroethene
Tetrachloroethene (Perchloroethylene)
1,2-Dichloropropane
1,3-Dichloropropene
Hexachlorobutadiene
Hexachlorocyclopentadiene
Bromomethane (Methyl Bromide)
Bromodichloromethane
Dibromochloromethane
Tribromomethane (Bromoform)

MONOCYCLIC AROMATIC HYDROCARBONS

Benzene
Chlorobenzene
1,2-Dichlorobenzene (o-Dichlorobenzene)
1,3-Dichlorobenzene (m-Dichlorobenzene)
1,4-Dichlorobenzene (p-Dichlorobenzene)
1,2,4-Trichlorobenzene
Hexachlorobenzene
Ethylbenzene
Nitrobenzene
Toluene
2,4-Dinitrotoluene
2,6-Dinitrotoluene
Phenol
2-Chlorophenol
2,4-Dichlorophenol
2,4,6-Trichlorophenol
Pentachlorophenol
2-Nitrophenol
4-Nitrophenol
2,4-Dinitrophenol
2,4-Dimethyl phenol
p-Chloro-m-cresol
4,6-Dinitro-o-cresol

TABLE 3 (continued)

POLYCYCLIC AROMATIC HYDROCARBONS

Acenaphthene
Acenaphthylene
Fluorene
Naphthalene
Anthracene
Fluoranthene
Phenanthrene
Benzo (a) anthracene
Benzo (b) fluoranthene
Benzo (k) fluoranthene
Chrysene
Pyrene
Benzo (ghi) perylene
Benzo (a) pyrene
Dibenzo (a,h) anthracene
Indeno (1,2,3-cd) pyrene

HALOGENATED ETHERS

Bis (2-chloroehtyl) ether
Bis (2-chloroisopropyl) ether
2-Chloroethyl vinyl ether
4-Chlorophenyl phenyl ether
4-Bromophenyl phenyl ether
Bis (2-chloroethoxy) methane

PHTHALATE ESTERS

Dimethyl Phthalate
Diethyl Phthalate
Di-n-butyl Phthalate
Butyl Benzyl Phthalate
Di-n-octyl Phthalate
Bis (2-ethylhexyl) Phthalate

POLYCHLORINATED BIPHENYLS AND RELATED COMPOUNDS

PCB-1016
Aroclor 1221
Aroclor 1232
Aroclor 1242
Aroclor 1248
Aroclor 1254
Aroclor 1260
2-Chloronaphthalene

NITROSAMINES AND OTHER N COMPOUNDS

Dimethyl nitrosamine
Diphenyl nitrosamine
Di-n-propyl nitrosamine
Benzidine
3-3'-Dichlorobenzidine
1,2-Diphenylhydrazine (Hydrazobenzene)
Acrylonitrile

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total output to the environment can be obtained from analysis of the particulate fraction. For instance, if most of the total amount of a certain metal in an effluent is associated with the particulate fraction, the total output of that metal might be reduced by reducing the amount of particulate matter in the effluent.

Samples of effluent should be collected as 24-h flow composites, except where grab samples are required to obtain representative measurements. 24-h flow composites are used to get a representative sample because many wastestream characteristics and flows, particularly for sanitary wastewater, vary substantially over a 24-h period. Grab samples, rather than composite samples, must be taken for certain variables (e.g., dissolved gases, volatile compounds, microbiological variables) because of changes that are likely to occur during storage. Effluent variables that must be measured from grab samples are pH, temperature, total and fecal coliform bacteria, dissolved oxygen, oil and grease, and volatile organic compounds. A list of recommendations for sample sizes, sample container materials, and maximum sample holding times is given for different variables in Tables 4 and 5.

Frequency of Sampling --

The frequency of sampling will vary with the discharge. For sanitary discharges with large volume stormwater flows, at least two low-flow and two high-flow events should be sampled for use in preliminary screening. For discharges that do not vary substantially on a day-to-day basis, the objective should be to collect a sufficient number of samples to fully cover varying flow conditions through an annual cycle. In addition, if an industrial activity or facility produces more of a certain product or waste in one season than in another, sampling should be conducted during all appropriate periods to ensure that all waste types produced are sampled. Because of the wide diversity of effluents, gaining a representation of the full spectrum of contaminants in the waste streams will require site-specific information. By necessity, the number of samples, exact sampling locations, times of sampling, and the variables analyzed must be based on site-specific factors such as variability in waste flow and waste characteristics.

There may exist situations in which industrial activities discharge wastewater directly into storm drains, sometimes known as combined storm drains (Tetra Tech 1987a). If the source is known, these discharges should be sampled at the source, or as close to the source as possible, but before they enter the storm drains. For cases in which a source is not readily identifiable, monitoring should be handled as part of the monitoring of nonpoint sources (discussed in Chapter 3 of this document).

Step 5 - Decision for Level 2 Analysis

Upon receipt of the results of Level 1 sampling, an analysis of the data should be conducted to determine whether contaminant levels exceed water quality criteria or established levels for protection of aquatic life. A discussion of the general approach for this analysis is given in Chapter 6

TABLE 4 RECOMMENDED SAMPLE SIZES, CONTAINERS, PRESERVATION, AND HOLDING TIMES FOR EFFLUENT SAMPLES[a]

Measurement	Minimum Sample Size[b] (mL)	Container[c]	Preservative[d]	Maximum Holding Time
pH	25	P,G	None	Analyze immediately[e]
Temperature	1,000	P,G	None	Measure immediately[e]
Turbidity	100	P,G,	Cool, 4°C	48 h
Total suspended solids	1,000	P,G	Cool, 4°C	7 days
Settleable solids	1,000	P,G	Cool, 4°C	48 h
Floating particulates	5,000	P,G	None	Analyze immediately[e,f]
Dissolved oxygen				
Probe	300	G bottle & top	None	Analyze immediately[e]
Winkler	300	G bottle & top	Fix on site; store in dark	8 h
Biochemical oxygen demand	1,000	P,G	Cool, 4°C	48 h
Total chlorine residual	200	P,G	None	Analyze immediately[e]
Oil and grease	1,000	G only	Cool, 4°C H_2SO_4 to pH<2	28 days
Nitrogen				
Ammonia-N	400	P,G	Cool, 4°C H_2SO_4 to pH<2	28 days
Total Kjeldahl-N	500	P,G	Cool, 4°C H_2SO_4 to pH<2	28 days
Nitrate + Nitrite-N	100	P,G	Cool, 4°C H_2SO_4 to pH<2	28 days
Phosphorus (total)	50	P,G	Cool, 4°C H_2SO_4 to pH<2	28 days
Priority pollutant metals				
Mercury	100	P,G	HNO_3 to pH<2	28 days
Metals, except mercury	100	P,G	HNO_3 to pH<2	6 mo
Priority pollutant organic compounds				
Extractable compounds (includes phthalates, nitrosamines, organo chlorine pesticides, PCBs, nitroaromatics, isophorone, polynuclear aromatic hydrocarbons, haloether, chlorinated hydrocarbons, phenols, and TCDD)	4,000	G only, TFE-lined cap	Cool, 4° C 0.008% $Na_2S_2O_3$[g] Store in dark	7 days until extraction 40 days after extraction
Purgeable compounds	40	G only, TFE-lined septum	Cool, 4°C 0.008% $Na_2S_2O_3$[g]	7 days[h]

EPA (1987)

TABLE 4 (Continued)

Total and fecal coliform bacteria	250-500	P,G	Cool, 4° C 0.008% $Na_2S_2O_3$[g]	6 h
Enterococcus bacteria	250-500	P,G	Cool, 4° C 0.008% $Na_2S_2O_3$[g]	6 h

[a] Reference: Adapted from U.S. EPA (1979b, 1984).

[b] Recommended field sample sizes for one laboratory analysis. If additional laboratory analyses are required (e.g., replicates), the field sample size should be adjusted accordingly.

[c] Polyethylene (P) or Glass (G)

[d] Sample preservation should be performed immediately upon sample collection. For composite samples each aliquot should be preserved at the time of collection. When use of an automated sampler makes it impossible to preserve each aliquot, the samples should be maintained at 4° C until compositing.

[e] Immediately means as soon as possible after the sample is collected, generally within 15 min (U.S. EPA 1984).

[f] No recommended holding time is given by U.S. EPA for floating particulates. Analysis should therefore be made as soon as possible.

[g] Should only be used in the presence of chlorine residual.

[h] Holding time and preservation technique for purgeable compounds are based on the use of U.S. EPA Method 624 for screening all priority pollutant "volatiles," including acrolein and acrylonitrile. If analysis of acrolein and acrylonitrile is found to be of concern, a separate subsample should be preserved by adjusting the pH to 4-5 and the sample should then be analyzed by U.S. EPA Method 603.

TABLE 5   RECOMMENDED METHODS FOR MEASURING EFFLUENT VARIABLES

Variable	Method Reference: U.S. EPA[a]	Method Reference: APHA[b]	Method Reference: Other[c]
pH	150.1	423	-
Temperature	170.1	212	-
Turbidity	180.1	214A	-
		214B	
Total suspended solids	160.2	209C	-
Settleable solids	160.5	209E	-
Floating particulates	-	206A[d]	-
Dissolved oxygen			
Probe	360.1	421F	-
Winkler	360.2	421B	
Biochemical oxygen demand	405.1	507	-
Total chlorine residual	330.1	408A	-
	330.2	408B	
	330.3	408C	
	330.4	408D	
	330.5	408E	
Oil and grease	413.1	503A	
Nitrogen			
Ammonia-N	350.1	417A	-
	350.2	417B	
	350.3	417D	
		417G	
Total Kjeldahl-N	351.1	417B	
	351.2	417D	
	351.3	417E	
	351.4	420A	
		420B	
Nitrate+Nitrite-N	353.1	418C	-
	353.2	418F	
	353.3		

EPA (1987)

TABLE 5 (Continued)

Phosphorus (total)	365.1 365.2 365.3 365.4	424C 424F 424G	
Priority pollutant metals	Table 1B[e] U.S. EPA (1984)	Table 1B[e] U.S. EPA (1984)	-
Priority pollutant Organic compounds	Table 1C[e] U.S. EPA (1984)	Table 1C[e] U.S. EPA (1984)	
Total coliform bacteria	-	908A[f] 909A[g]	p. 114[f,h] p. 108[g,h]
Fecal coliform bacteria	-	908C[f] 909C[g]	p. 132[f,h] p. 124[g,h]
Enterococcus bacteria	-	-	U.S. EPA[i]

[a] Methods recommended in U.S. EPA (1979b).

[b] Methods recommended in APHA (1985).

[c] Methods recommended in sources other than U.S. EPA (1979) or APHA (1985) when no methods were recommended in the latter two sources.

[d] This method is tentatively recommended by APHA.

[e] The list of U.S. EPA and APHA methods for individual components of this group are listed in the table specified and are too extensive to include here.

[f] This method can be used whether or not chlorine is present.

[g] This method can be used only when chlorine is absent.

[h] Page reference of this method in Bordner et al. (1978).

[i] U.S. EPA is currently finalizing a recommended method for this variable.

of this document. If sampling results conclusively show little or no excess contamination above background levels, then additional sampling is not necessary. If sampling results are inconclusive, due to inconsistent results or are borderline in terms of acceptable water quality conditions, then the sampling program should be repeated, preferably under different seasonal conditions. If sampling results show conclusively that a contamination problem exists, Level 2 analysis should be undertaken which would concentrate on waste source identification and evaluation.

CHAPTER 3. NONPOINT SOURCE MONITORING

INTRODUCTION

Nonpoint source pollution is difficult to monitor because of its diffuse and intermittent nature. Nonpoint source problems are generally created when drainage water comes into contact with pollutants that have accumulated on the land surface or within the soil profile. As shown in Figure 4, nonpoint source pollution is transported to stream and estuary systems via surface water runoff and groundwater inflow. Contamination from surface water runoff is discussed in this section. Groundwater contamination is discussed separately in Chapter 4.

Surface water runoff is intermittent as it is related to precipitation conditions. Peak runoff periods, and therefore the bulk of the nonpoint loading, generally occur during intense rainfall events. This phenomenon is also related to the fact that many pollutants adsorb onto soil particles and are transported by surface runoff as particulates. Because sediment carrying capacity of a stream increases with increasing discharge, larger contaminant loads are often observed under high flow conditions.

Nonpoint pollution is generally related to land use. Typical land use sources include industrial, residential, commercial, agricultural, and silvicultural activities. The primary uses associated with the DoD installations have been identified as industrial and agricultural activities and disturbed areas. Specific operations that are potential sources of nonpoint pollution include waste disposal practices (e.g., landfills, waste dumps, fire training pits), fuel storage and refueling operations, erosion, spills, and munitions operations.

SAMPLING DESIGN

Step 2 - Preliminary Site Investigation

Specific site characteristics must be identified before a monitoring program can be designed. This identification includes determining surface drainage patterns and pathways, defining drainage basin areas, and identifying land use characteristics and potential pollutant sources in each individual drainage basin. Site characteristic information should be available from records kept at each installation. Engineering site plans, maps of facility storm drain and drainage systems, and existing topographic maps are specific items that are needed. If detailed plans are not available, a field reconnaissance of the installation will be required to delineate drainage basins and identify contributing areas. Engineering plans should also be reviewed to identify possible industrial connections to the storm drain system (e.g., floor drains from maintenance areas). The outfalls for all storm drain lines and drainage ditches serving the site should be located. In addition, information on potential problem areas such as abandoned waste disposal sites, uncontained waste storage areas, improper waste disposal practices, and past spills should be evaluated to identify areas of concern.

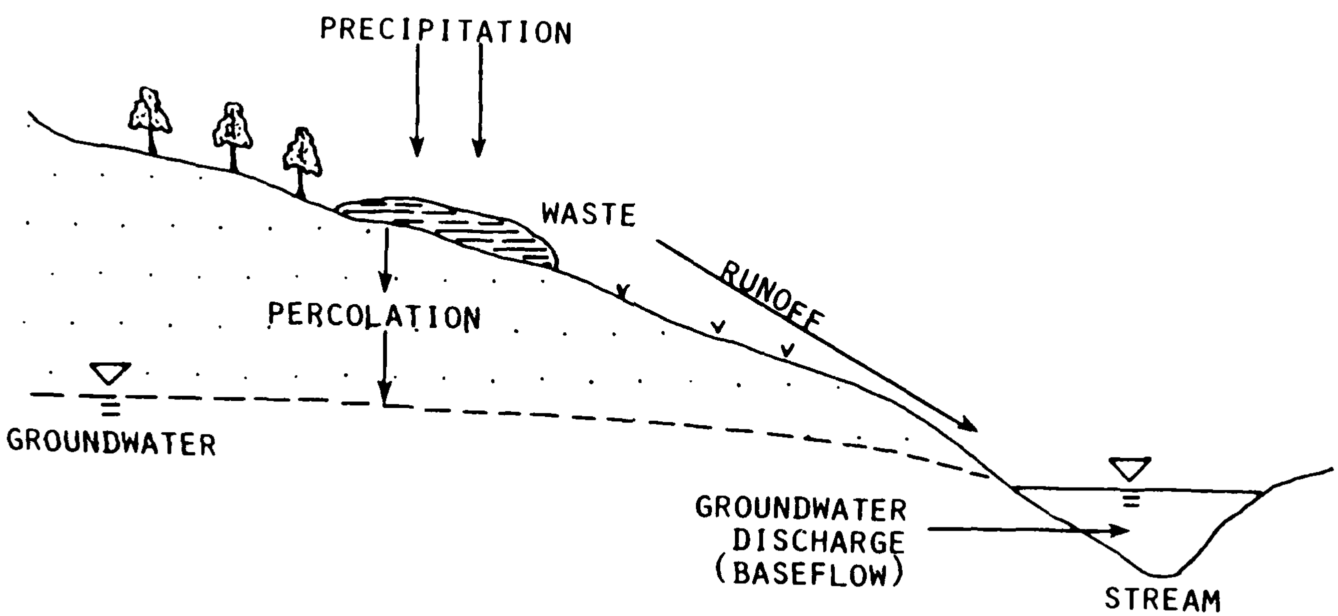


Figure 4 Nonpoint source pollution processes.

Step 3 - Level 1 Sampling Design for Receiving Water

Because there are typically no data available to characterize nonpoint pollution problems at most of the DOD installations, it is recommended that an initial screening level investigation be conducted to identify problem areas. The emphasis of the screening program is primarily on the receiving environment rather than at the source. This approach is recommended because of the number of and difficulty in monitoring nonpoint sources, in addition to determining whether discharges from DOD installations are impacting Chesapeake Bay or its tributaries. The identification of contaminated areas in the receiving environment would signal that further investigation is required to locate and control the specific sources responsible for the contamination. These additional investigations should be conducted during a separate Level 2 analysis.

The screening approach consists of collecting grab samples of surficial sediments offshore of the DoD installation. Collection of sediment rather than water column samples is recommended because many contaminants accumulate in sediments. Sediments tend to act as a sink, and unlike the water column, are not subject to large temporal variations in chemical concentrations. Sediment samples would be collected on a one-time basis only.

A sampling plan that targets the potential sources identified during the preliminary site investigation should be designed for each installation. In addition, the sampling plan should provide sufficient coverage of the offshore environment to define concentration gradients linking the contaminated area to discharges from the DoD facility. Sampling of individual sources is only recommended for sources that are strongly suspected of contributing contaminants to the bay or its tributaries. This selection would be based on the information obtained during the preliminary site investigation.

DoD installations may discharge to either a stream or estuarine environment. The requirments for sampling in each of these receiving environments are discussed below.

Estuary Sampling Scheme --

Surficial sediment samples (top 2 cm layer) should be collected offshore of the DoD installations. The number of samples required will depend on the length of the shoreline, the number of storm drain outfalls, and the complexity of the DoD installation. An example sampling plan for a typical DoD facility is shown in Figure 5. Nearshore sampling stations are located adjacent to the major source areas. Additional nearshore sampling stations are provided between source areas and beyond the property boundaries of the installation to delineate the extent of the contaminated area and to define concentration gradients. Similarly, several stations are located offshore of the facility.

Recommended procedures for the collection of marine and estuarine sediment samples are described in U.S. EPA (1987). In addition to using appropriate

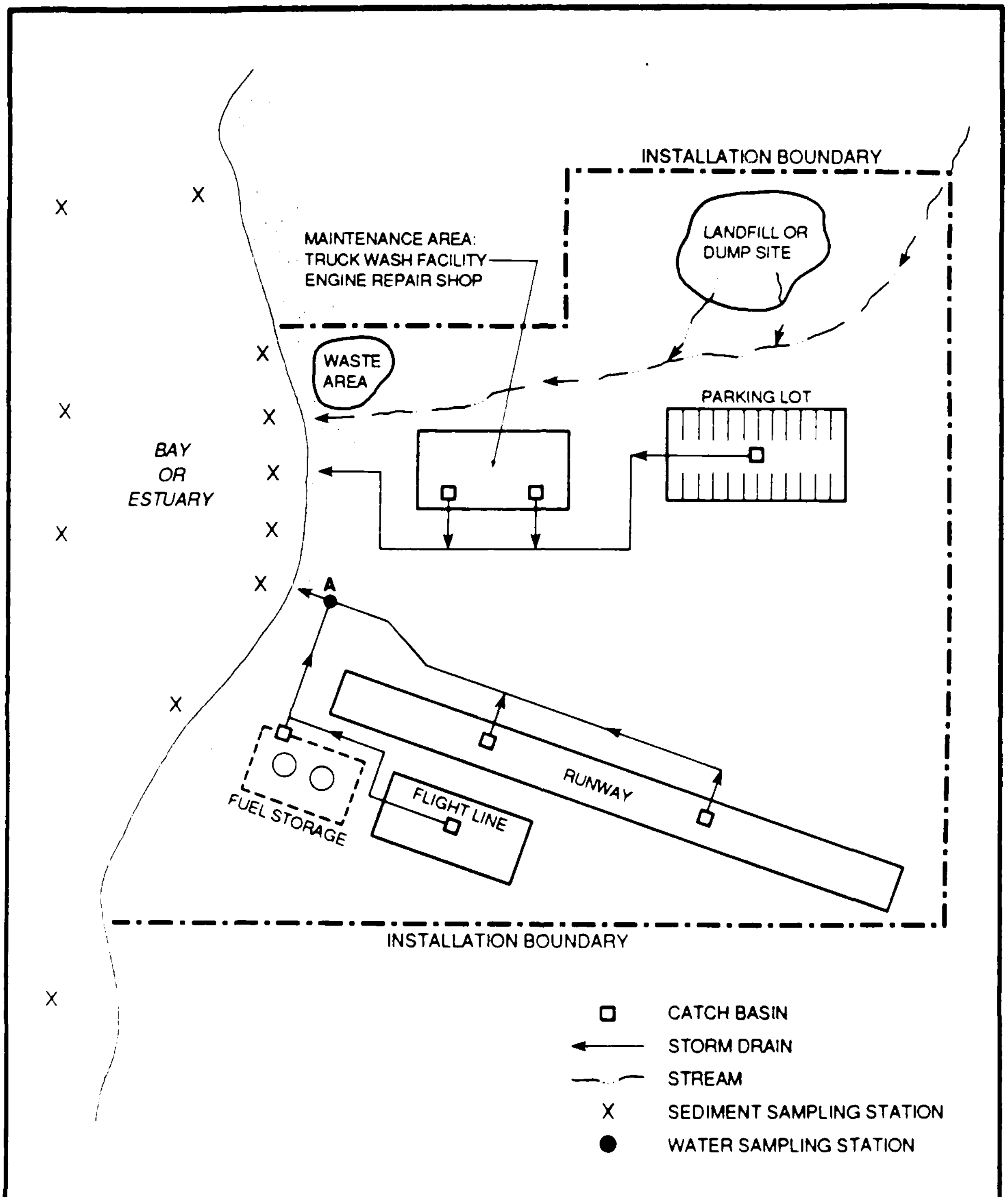


Figure 5 Example monitoring program for a nonpoint source discharging to a bay or estuary.

sampling techniques, accurate navigation is essential to precisely document the location of all samples collected. The station positioning system selected for the survey should provide both accurate and precise (i.e., repeatable) location readings.

The type of pollutants present in nonpoint source discharges are a function of the waste sources in the basin. Pollutants that are typically found in surface water runoff include conventional pollutants (total suspended solids, BOD, grease, oil), nutrients, and metals. In addition, runoff from maintenance areas, firing ranges, and waste disposal sites may contain a variety of organic compounds. Because of the diverse and unknown composition of waste materials that may be present at DoD installations, it is recommended that all sediment samples be analyzed for priority pollutants (Table 3) as well as conventional pollutants and physical properties (e.g., total organic carbon, oil and grease, grain size). Other site-specific wastes such as munitions compounds and chemicals used in research facilities should also be analyzed where applicable.

River and Streams Sampling Scheme --

An initial screening program similar to the above plan for estuaries is recommended for DoD installations that discharge to rivers and streams. Again, sampling of surficial sediments offshore of the facility is preferred to water column sampling. A one time sediment sampling program provides a quick and relatively inexpensive evaluation of contaminant problems related to discharges from the installation. However, in some cases it may not be possible to locate depositional areas within the adjacent river environment

due to the hydraulic characteristics of the river. Contaminants discharged for nonpoint sources may be washed downstream by flow in the river and not settle out in the streambed offshore of the installation. In this situation, water column sampling would be required.

An example sampling plan for a typical DoD installation is shown in Figure 6. Sediment sampling stations are located off the right bank of the river opposite the major source areas. In addition, sampling stations are located at the upstream and downstream boundaries of the site. These additional stations aid in identifying the extent of the contamination. The upper station is used to determine "baseline" contamination levels in the sediments above the influence of discharges from the DoD installation. Again, sediment sampling in a river environment will only be feasible for rivers with a very low hydraulic gradient.

Sediment sampling procedures are similar to those described for the estuarine environment, with samples collected on a one-time basis from the upper 2-cm sediment layer. Sampling station locations should be carefully documented. Parameters analyzed on the samples include conventional pollutants and physical properties (e.g., total organic carbon, grain size, moisture content, oil and grease), priority pollutants (Table 3), and any chemical compounds that may be unique to the DoD installation.

Due to flow conditions in the receiving environment, it may not be feasible to sample surficial sediments offshore of many of the DoD installations discharging to rivers and streams. In these cases, it is recommended that water column samples be collected for contaminant analysis. The number of sampling stations required will depend on the size of the facility and the number of nonpoint source discharges. At a minimum, the sampling program should include stations at the upstream and downstream boundaries of the site. However, at many of the DoD installations, such as the example shown in Figure 6, additional stations will be required along the section of river adjacent to the property.

Water samples will have to be collected several times under varying flow conditions to characterize impacts from the DoD installation. It is recommended that samples be collected at lease twice (sampling events separated by at least 2 wk) under low flow (i.e., base flow) conditions and during several rainfall events. Low flow conditions typically occur during the summer months when there are long periods with no precipitation. During these periods, there is little or no contribution from surface runoff from the site. Therefore, it is often possible to isolate the effects from the inflow of contaminated groundwater. Rainfall or high flow event sampling is required to characterize effects in the river from surface runoff originating on the DoD installation. Because rainfall and site runoff conditions are highly variable, it will be necessary to sample several events to determine the range of water quality effects within the river. Rainfall event sampling should be conducted during or immediately after the rainfall period when surface runoff from the site is discharging to the river.

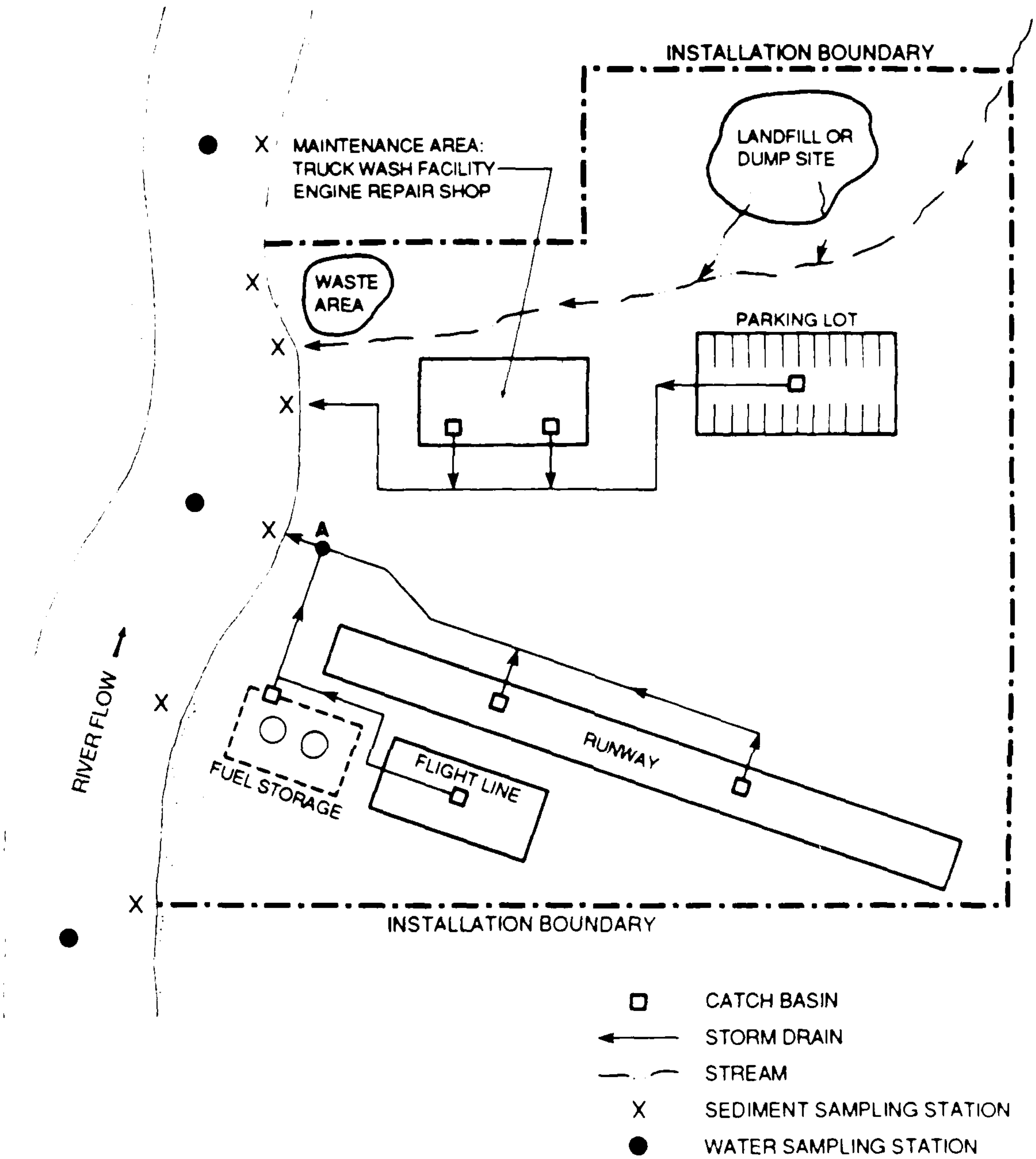


Figure 6 Example monitoring program for a nonpoint source discharging to a river.

Field sampling techniques must be suitable to ensure that representative discharge samples are collected. It is recommended that standard U.S. Geological Survey (USGS) sampling techniques be used (Kroter and Garst 1985). These procedures involve collecting vertically and horizontally composited samples across the channel cross section. Flow should be measured at each sampling station so that contamination loading calculations and mass balances analyses can be performed. Standard USGS (1968) procedures using current meters are recommended.

Chemical parameters that should be analyzed in the water samples include total suspended solids, total organic carbon, oil and grease, nutrients (nitrate, nitrite, ammonia, total phosphorous) priority pollutants (Table 3) and any chemical compounds unique to that particular facility, such as munitions compounds. The priority pollutant metals and organic compounds should be analyzed on a bulk water sample and on the particulate fraction. Separate analysis of the suspended solids material is recommended because many of these contaminants are adsorbed onto soil particles and transported as particulate material. The concentration of contaminants transported in the dissolved phase can be calculated by subtracting the particulate concentration from the total concentration of material in the sample. Additional parameters that should be measured in the field include flow, temperature, salinity, pH, and dissolved oxygen.

Step 4 -Level 1 Sampling Design for Sources

Sampling of individual sources is recommended only if a particular source is strongly suspected of contributing contaminants to the river or estuary. This determination should be made based on the information obtained during the preliminary site investigation. Otherwise, source sampling should be reserved for Level 2 analysis after the results of the Level 1 receiving environment investigation has been reviewed and specific problem areas can be identified.

If justified, Level 1 screening of sources (Step 4) should be conducted at the same time as the Level 1 receiving environment sampling program (Step 3). Source samples should be collected near the point of discharge to the river or estuary. For example, in Figure 5, a sample would be collected from Point A in the stream drain line serving the runway and fuel storage area.

The type of sample collected and the parameters measured in the source samples should be identical to and follow the same procedures as are used for the receiving environment samples (Step 3). For example, if surficial sediment samples are collected from the estuary offshore of the site, sediment samples should also be collected from the problem source. Grab samples can be collected from sediments accumulated in storm drain lines or from drainage ditches. Access to storm drain lines is available at manholes. Manholes often act as sediment traps, providing a good source of sediments for sampling. Storm drain and drainage ditch sampling should be conducted during dry periods to provide easy access to the systems.

Source sediment samples should be analyzed for the same chemical compounds as are measured in the sediment samples collected from the receiving environment (conventional parameters, total organic carbon, grain size, moisture content, and priority pollutants). This sampling strategy will allow a comparison of the relative distribution of the contaminants in each type of sample and will help to confirm that a given source is responsible for the contamination found in the receiving environment.

Source Sampling--

Samples of nonpoint source discharges should be collected if the source discharges into a river where water samples rather than sediment samples are needed to characterize effects in the receiving environment (i.e., rivers with steep hydraulic gradients and no areas of sediment deposition). Nonpoint source discharge samples must be collected at the same time the receiving water samples are collected. Consequently, nonpoint source discharge samples will be collected on several different occasions under varying flow conditions. This strategy allows for comparisons between contaminant mass loadings in the river and in the source. In addition, sampling during dry periods will help to identify storm drains that receive discharges from sources other than surface runoff (i.e., industrial discharges).

Grab samples should be collected from the storm drain or drainage ditch outfall. Parameters to be analyzed should be the same as are measured in the river samples (i.e., pH, total suspended solids, total organic carbon, oil and grease, nutrients, priority pollutants, and chemicals unique to the facility). Priority pollutants should be analyzed on bulk water and particulate fraction samples.

Step 5 - Decision for Level 2 Analysis

Upon receipt of the results of Level 1 sampling, analysis of the data should be conducted to determine whether contaminant levels exceed water quality criteria or established levels for protection of aquatic life. A discussion of the general approach for this analysis is given in Chapter 6 of this document. If sampling results conclusively show little or no excess contamination above background levels, then additional sampling is not necessary. If sampling results are inconclusive, due to inconsistent results or are borderline in terms of acceptable water quality conditions, then the sampling program should be repeated, preferably under different seasonal conditions. If sampling results show conclusively that a contamination problem exists, Level 2 analysis should be undertaken which would concentrate on waste source identification and evaluation.

CHAPTER 4. GROUNDWATER

INTRODUCTION

The primary activities at DoD installations that have been identified as creating potential groundwater contamination problems include leaks and spills from fuel storage facilities, leachate from abandoned waste sites, residues from munitions wastes, spills occurring during refueling operations, and chemical spills that have not been cleaned up properly. Although groundwater contamination is a major problem in itself due to degradation of the resource and impacts on beneficial uses (e.g., domestic, industrial, agricultural), the primary concern of the Chesapeake Bay Restoration and Protection Program is the effects that the discharge of contaminated groundwater has on surface water quality and biota in Chesapeake Bay and its tributaries.

As discussed in the previous section on nonpoint sources, groundwater contamination is a nonpoint source pollution problem caused by activities on the land surface (Figure 4). However, groundwater also acts as a pathway and can transport contaminants to surface water supplies via the groundwater flow system. The approach recommended for groundwater monitoring is similar to the approach for monitoring nonpoint pollution sources. Initial screening (Level 1) is conducted in the receiving environment followed by specific source identification and characterization in a Level 2 investigation phase. However, for DoD installations where groundwater contamination is strongly suspected, it is recommended that a monitoring program be initiated during the Level 1 investigation. Guidelines for conducting a groundwater investigation are presented in the following sections.

SAMPLING DESIGN

Step 2 - Preliminary Site Investigation

The objectives of the preliminary site investigation for groundwater pollutant sources are similar to those described for the nonpoint pollution sources. Available information on site activities and groundwater conditions is compiled to focus the initial screening level investigation on potential problem areas. Records should be reviewed to identify potential sources such as landfill sites, reports of spills from fuel storage and refueling areas, and munitions testing areas. For landfill sites, the kinds and quantities of materials disposed are of particular interest. If leakage is suspected from fuel storage facilities, plant records should be reviewed to determine whether losses of product can be documented. In addition, it is recommended that general information on groundwater conditions beneath the site be collected to identify areas with shallow water tables that have a high potential for contamination from surface activities.

A field survey should be conducted after potential problem areas have been identified. This survey should delineate areas of stressed vegetation,

stained soils, surface seeps of contaminated groundwater, or the presence of sheens on surface drainage. This information can be used to aid in determining the potential magnitude of the subsurface problem.

Step 3 - Level 1 Sampling Design for Receiving Environment

The Level 1 screening investigation for groundwater sources is identical to the program recommended for nonpoint sources (i.e., surface water runoff), with the emphasis on sampling in the receiving environment to document effects from DoD installations. The two programs should be conducted in conjunction with one another.

Additional receiving environment samples required to document the effects from discharges of contaminated groundwater should be selected based on the information gathered during the preliminary site investigation. To develop an integrated sampling plan, these additional sampling stations should be combined with the stations selected for the investigation of effects from surface water runoff as described in the nonpoint source section. For example, in Figures 5 and 6, the nearshore sampling station adjacent to the waste storage area would satisfy the requirements for both the surface runoff and groundwater inflow impact determinations. The sampling techniques and parameters analyzed in samples for the groundwater investigation are the same as those recommended for the nonpoint sampling program.

Due to the diffuse nature of these nonpoint sources, it is unlikely that the effects on Chesapeake Bay and its tributaries from groundwater inflow will be distinguishable from the effects of surface runoff discharges. Additional field sampling will be required to identify specific contaminant sources and should be scheduled in a Level 2 study based on the results of the initial screening.

Step 4 - Level 1 Sampling Design for Sources

As has already been explained, monitoring of groundwater quality during the initial screening investigation is recommended only for those areas where contamination is strongly suspected. Most groundwater monitoring and source identification activities should be reserved for a later, more detailed investigation (i.e., Level 2). Recommendations for a Level 1 groundwater sampling program are described below. However, it should be emphasized that due to the complexity of most groundwater contamination problems, it is not possible to develop detailed design requirements. The following discussion is intended to provide general guidelines for initiating a groundwater monitoring program. In many cases, it will be necessary to contact a groundwater specialist for assistance.

The first step in designing a monitoring program for areas with suspected groundwater contamination problems involves compiling available groundwater information to develop an understanding of the groundwater system beneath the suspected problem areas. The kinds of information that would be helpful

are depth to groundwater, groundwater flow direction and velocity, the type of aquifer (i.e., artesian, semi-confined, water table), depth and thickness of the aquifer, location of confining layers, groundwater recharge and discharge points, hydraulic conductivity and transmissivity, and locations of existing wells that could be used in the sampling program. This information can be used to develop a broad conceptual model of the groundwater system and will aid in designing the sampling program.

It is recognized that site-specific groundwater data will probably not be available at many of the DoD installations. In these cases, it is recommended that at a minimum, USGS reports, state geological survey reports, or academic studies be used to define regional groundwater conditions.

Information should also be compiled on the kinds of waste material disposed or stored at the site, and their chemical characteristics (e.g., solubility, adsorption potential, chemical reactivity). This information will aid in selecting the contaminants to be analyzed and in determining the mobility of the contaminants in the groundwater system.

Groundwater monitoring programs are usually approached as drill and discovery investigations. A phased installation of monitoring wells is used to confirm that groundwater contamination exists with subsequent wells installed as necessary to determine the extent of the contamination. Confirmation of groundwater contamination should be the primary objective of Level 1 investigations at DoD installations. Characterizing the extent and nature of the contaminant phase requires a more extensive investigation and would be the subject of a Level 2 study.

An example of a groundwater contamination site is shown in Figure 7. The source of contamination can be either a LUST, abandoned waste site, or an existing landfill. The normal rule of thumb in designing a groundwater contamination investigation is that at least one upgradient and two downgradient monitoring wells are required (Figure 8). However, in most cases more wells will be needed to adequately define the extent and severity of the problem.

Assuming worst case conditions (i.e., no available groundwater information to define the groundwater flow system or aquifer characteristics), the recommended approach is to initially install a monitoring well at point A (Figure 7) which is most likely downgradient of the contaminant source. Well A would intercept the contaminant plume if the groundwater flow was in the direction of the bay or river. For initial monitoring wells, the suggested procedure is to place wells immediately downgradient of the suspected source and to install relatively shallow wells with long screen lengths. This strategy maximizes the chance of intercepting the contaminant plume.

Special techniques are required to install wells to monitor groundwater contamination. The services of an experienced well driller and use of specific installation procedures and materials are required. Recommended procedures for monitoring well installation are explained in (U.S. EPA 1986,

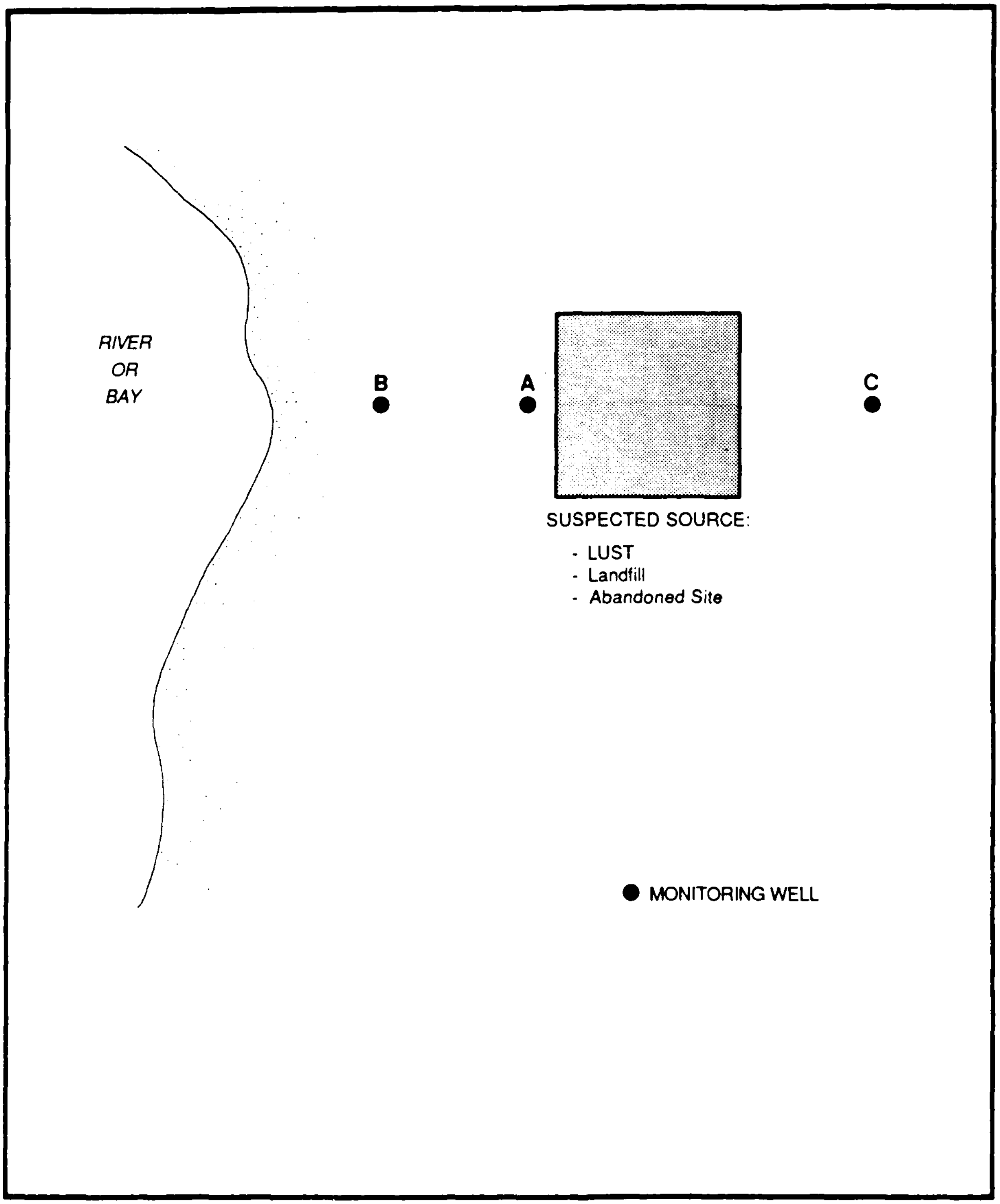
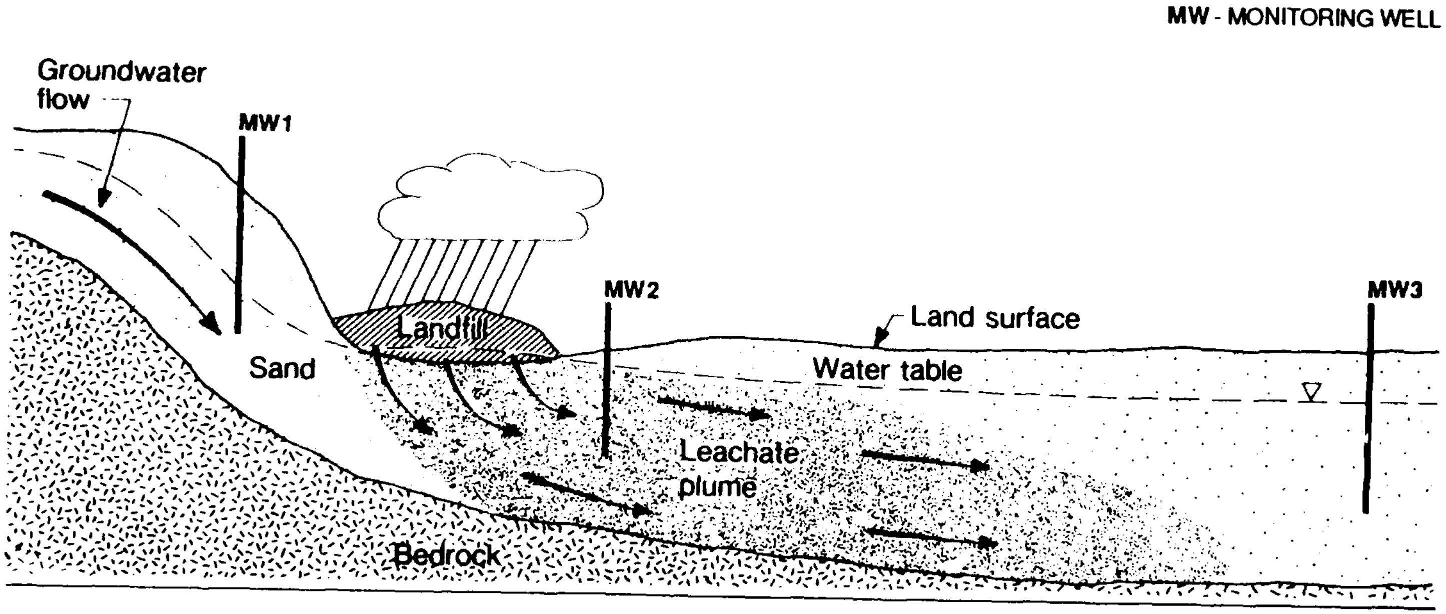


Figure 7 Example sampling plan for a groundwater contamination site.



Reference: Driscoll (1986).

Figure 8 Example of a typical groundwater monitoring network.

Barcelona et al. 1984, Driscoll 1986). In addition, lysimeters should be installed within the suspected source area to monitor the vadose (i.e., unsaturated) zone beneath the site. Lysimeters will provide early detection of contamination in the leachate from the site, before it reaches the aquifer. Soil samples should also be collected from the lysimeter drill holes to screen for contamination in the soil profile.

After the well has been installed and developed, water samples should be collected from the well and lysimeters to screen for chemical contaminants. Whole water samples should be analyzed for pH, temperature, specific conductance, major cations (calcium, magnesium, sodium, potassium) and anions (bicarbonate, sulfate, chloride), priority pollutants (Table 3), and any chemical compounds unique to the site such as munitions related compounds. Soil samples should be analyzed for priority pollutants and chemical compounds unique to the installation. In addition, pH, moisture content, total organic carbon, and grain size should also be measured in each soil sample.

Step 5 - Decision for Level 2 Analysis

Upon receipt of the results of Level 1 sampling, an analysis of the data should be conducted to determine whether contaminant levels exceed water quality criteria or established levels for protection of aquatic life. A discussion of the general approach for this analysis is given in Chapter 6 of this document.

If no contamination is found during the initial screening, it is recommended that monitoring of the well and lysimeters be conducted on a yearly basis. This approach will allow early detection if 1) groundwater contamination already exists but the plume has not yet migrated as far down gradient as the monitoring well, or 2) if contamination develops at a later date.

If contaminants are detected in the monitoring well during the initial screening sampling, additional monitoring wells will have to be installed to determine the extent of the contamination. Additional monitoring wells would be installed during the Level 2 analysis. The general approach to Level 2 investigation is briefly described below.

Step 6 - Level 2 Analysis

If contamination is found in Well A, additional downgradient wells (Well B in Figure 7) should be installed to determine the extent of the contamination. Sufficient well coverage is needed to define both the longitudinal and lateral flow directions and hydraulic gradients. In addition, estimates of hydraulic conductivity should be made using either field or laboratory tests. For detailed investigations, wells are often installed in clusters (several wells are installed at one location, but each well is completed and screened at a different depth in the aquifer) to determine the stratification of contaminants within the plume and to measure vertical hydraulic gradients. A monitoring well upgradient of the site (Well C in

Figure 7) should also be installed to characterize ambient groundwater conditions and to determine whether the contamination has migrated upgradient of the site. This well would be of particular concern in tidally influenced areas where the groundwater flow direction may change with tidal level.

CHAPTER 5. OTHER DISCHARGES

OVERVIEW

There are a variety of other sources of contaminants from DoD installations that do not fit into the previous categories. Some of these sources include ship refueling operations, dry dock operations, and materials that have been dumped directly into a waterway in the past and are still leaching material. In Level 1 of the monitoring program, the sources themselves will not be sampled because of the intermittent nature of the sources or other aspects of the sources that cause difficulty in sampling. Rather, only the receiving environment will be sampled.

For those discharges directly into an estuary, sediments around the discharge area (Figure 9) should be sampled and tested for priority pollutants and process and munitions compounds. Oil and grease should also be analyzed. The number and locations of sampling sites will vary greatly depending on the type, size, and location of the discharge. The sediments need be sampled only once for Level 1 of the monitoring program. If a problem is suspected, further sampling of the receiving environment and of the discharge may be warranted. Visual observations of conditions near the discharge area will be especially important for these kinds of discharges. Observations of surface slicks, turbidity, floating materials, discoloration of the receiving water, and notes of procedures apparently causing the discharge should be recorded.

For those discharges into a river or stream, the water column just upstream and downstream of the discharge area should be sampled to determine whether a net effect can be noted. Sediments downstream can be sampled if the area is a depositional environment or if it is unknown whether that river stretch is a depositional environment. Samples should be analyzed using the same procedures as for the estuary samples.

For those special cases in which there has historically been a dump of some material directly into a stream or other receiving environment, sediments downstream or around the dump site should be sampled for priority pollutants and process and munitions compounds. For these cases, it is very important to attempt to determine through other information sources (e.g., interviews with personnel, old records) what material was dumped at a site. This determination could potentially save some expensive sampling and analysis costs and contribute to a quick assessment of potential remedies.

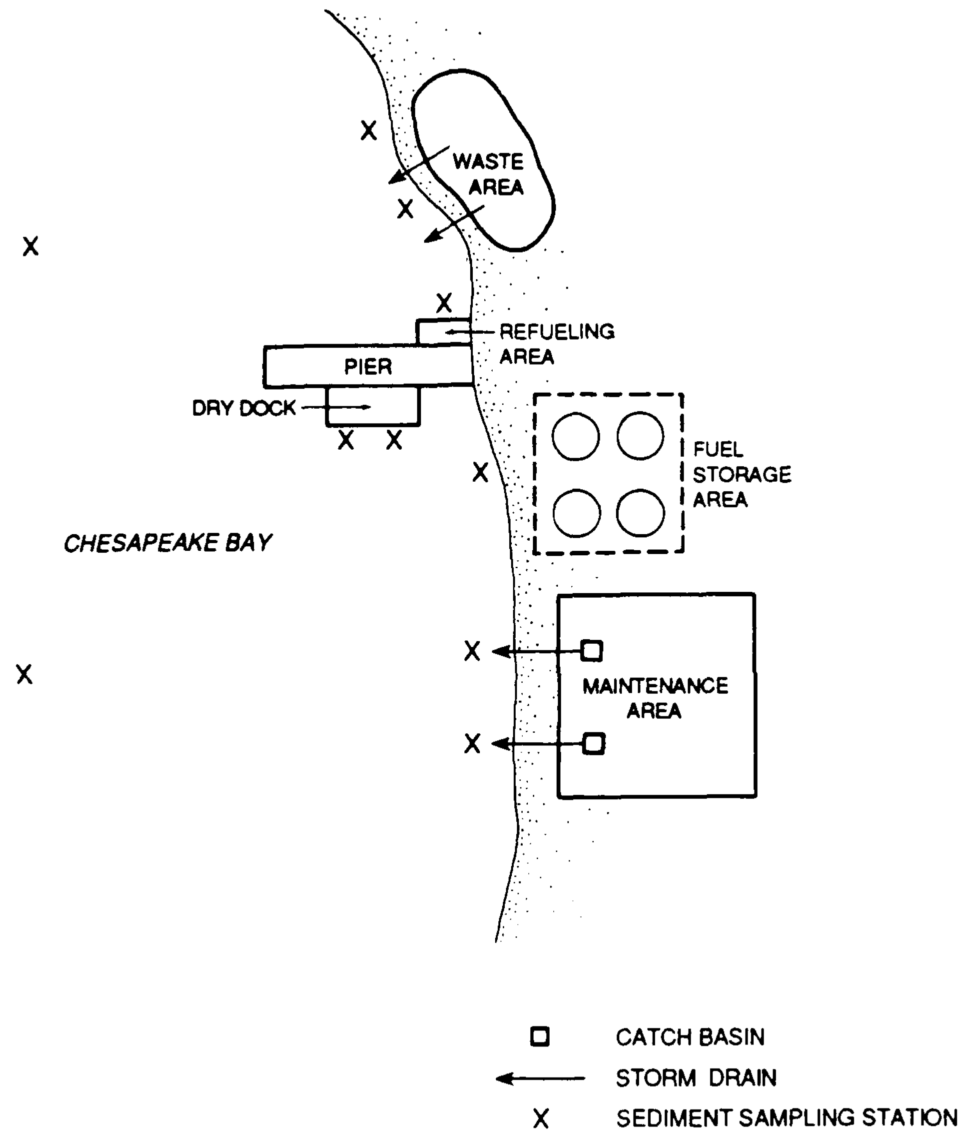


Figure 9 Example of direct discharges to an estuarine environment from a DoD installation.

CHAPTER 6. DECISION CRITERIA

OVERVIEW

One of the primary goals of the monitoring program is to provide a preliminary assessment of whether an installation has a problem with contaminants emanating from its facility and impacting Chesapeake Bay or its tributaries. To assess whether a "problem" exists, decision criteria must be developed so that the data obtained from the monitoring program can be appropriately evaluated. Because of the great variety of potential contaminants, their effects on the environment, and the differing degree of regulation of contaminants according to Federal, state, and local laws, only an outline of available types of decision criteria can be provided in this document.

The criteria can be divided into the following categories: water quality, point discharges, and sediments. One of the primary decision criteria for water quality concerns is whether the contaminant concentration exceeds water quality standards. Federal, state, and local water quality regulations can vary considerably, so personnel from an installation should be knowledgeable about all applicable regulations. A summary of available U.S. EPA saltwater aquatic life criteria and saltwater aquatic life toxicity concentrations is provided in Table 7.

In addition to the above sources of information, appropriate divisions within the DoD should be consulted to determine whether DoD has their own regulations. For those contaminants not regulated, an idea of the relative importance of a concentration of a contaminant can be made by comparing concentrations of the contaminant measured in other parts (i.e., reference areas) of Chesapeake Bay. Decisions will be needed as to the degree of elevation above reference concentration that could be considered as appropriate for further action. However, recommendations of those exceedance levels is beyond the scope of this document.

For point discharges, several other regulations are applicable for decision criteria. If a permit has been issued for a discharge, then violation of the permit limits is cause for action. Other regulations such as hazardous waste regulations, laws pertaining to allowable types of discharges, and any other applicable laws identified can serve as criteria for further action. Consideration could be given to complaints by the public about certain discharges. As always, the Department of Defense and local agencies should be consulted.

For sediments, criteria for further action are less well defined. Few, if any, criteria have been set for sediment concentrations of contaminants. For these cases, therefore, the approach of using elevation above reference should be used. Again, the actual values to use for the criteria for elevation above reference is beyond the scope of this document. Setting of the criteria values is not a simple or noncontroversial task. The criteria should be based on site-specific data such as bioassays.

TABLE 7. SUMMARY OF AVAILABLE U.S. EPA SALTWATER QUALITY CRITERIA AND SALTWATER AQUATIC LIFE TOXICITY CONCENTRATIONS

Pollutant	Saltwater Aquatic Life Criteria (ug/L) Acute: Not to Exceed at Any Time[a]	Acute: Maximum 1-h Average[b]	Chronic: Maximum 24-h Average[a]	Chronic: Maximum 96-h Average[b]	Saltwater Aquatic Life Toxicity Concentration (ug/L)[c]: Acute	Chronic
Acenaphthene	d	d	d	d	970	710
Acrolein	d	d	d	d	55	e
Acrylonitrile	d	d	d	d	e	e
Aldrin	1.3	d	d	d	f	e
Dieldrin	0.71	d	0.0019	d	f	f
Antimony	d	d	d	d	e	e
Arsenic	g	69	g	36	f	f
Asbestos	d	d	d	d	e	e
Benzene	d	d	d	d	5,100	700
Benzidine	d	d	d	d	e	e
Beryllium	d	d	d	d	e	e
Cadmium	g	43	g	9.3	f	f
Carbon tetrachloride	d	d	d	d	50,000	e
Chlordane	0.09	d	0.0040	d	f	f
Chlorinated benzenes	d	d	d	d	160	129
Chlorinated ethanes	d	d	d	d	e	e
1,2-dichloroethane	d	d	d	d	113,000	e
1,1,1-trichloroethane	d	d	d	d	31,200	e
1,1,2,2-tetrachloroethane	d	d	d	d	9,020	e
Pentachloroethane	d	d	d	d	390	281
Hexachloroethane	d	d	d	d	940	e
Chlorinated naphthalene	d	d	d	d	7.5	e
Chlorinated phenols	d	d	d	d	e	e
2,3,5,6-tetrachlorophenol	d	d	d	d	440	e
4-chlorophenol	d	d	d	d	29,700	e
Chloroalkyl ethers	d	d	d	d	e	e
Chloroform	d	d	d	d	e	e
2-chlorophenol	d	d	d	d	e	e
Chromium	d	d	d	d	e	e
Trivalent chromium	d	d	d	d	10,300	e
Hexavalent chromium	g	1,100	g	50	f	f
Copper	g	2.9	g	2.9	f	f
Cyanide	g	1.0	g	1.0	f	f
DDT and metabolites	0.13	d	0.0010	d	f	f
TDE	d	d	d	d	3.6	e
DDE	d	d	d	d	14	e
Dichlorobenzenes	d	d	d	d	1,970	e
Dichlorobenzidines	d	d	d	d	e	e
Dichloroethylenes	d	d	d	d	224,000	e
2-dichlorophenol	d	d	d	d	e	e
Dichloropropanes	d	d	d	d	10,300	3,040
Dichloropropenes	d	d	d	d	790	e
2,4-dimethylphenol	d	d	d	d	e	e
2,4-dinitrotoluene	d	d	d	d	590	e

TABLE 7 (Continued)

Pollutant	Saltwater Aquatic Life Criteria (ug/L) Acute: Not to Exceed at Any Time[a]	Acute: Maximum 1-h Average[b]	Chronic: Maximum 24-h Average[a]	Chronic: Maximum 96-h Average[b]	Saltwater Aquatic Life Toxicity Concentration (ug/L)[c] Acute	Chronic
1,2-diphenylhydrazine	d	d	d	d	e	e
Endosulfan	0.034	d	0.0087	d	f	f
Endrin	0.037	d	0.0023	d	f	f
Ethylbenzene	d	d	d	d	430	e
Fluoranthene	d	d	d	d	40	16
Haloethers	d	d	d	d	e	e
Halomethanes	d	d	d	d	12,000	6,400
Heptachlor	0.053	d	0.0036	d	f	f
Hexachlorobutadiene	d	d	d	d	32	e
Hexachlorocyclohexane	d	d	d	d	e	e
Lindane	0.16	d	d	d	f	e
BHC	d	d	d	d	0.34	e
Hexachlorocyclopentadiene	d	d	d	d	7.0	e
Isophorone	d	d	d	d	12,900	e
Lead	g	140	g	5.6	f	f
Mercury	g	2.1	g	0.025	f	f
Naphthalene	d	d	d	d	2,350	e
Nickel	140	d	7.1	d	f	f
Nitrobenzene	d	d	d	d	6,680	e
Nitrophenols	d	d	d	d	4,850	e
Nitrosamines	d	d	d	d	3,300,000	e
Pentachlorophenol	d	d	d	d	53	34
Phenol	d	d	d	d	5,800	e
Phthalate esters	d	d	d	d	2,944	e
Polychlorinated biphenyls	d	d	0.030	d	e	f
Polynuclear aromatic hydrocarbons	d	d	d	d	300	e
Selenium	410	d	54	d	f	f
Silver	2.3	d	d	d	f	e
Tetrachloroethylene	d	d	d	d	10,200	450
Thallium	d	d	d	d	2,130	e
Toluene	d	d	d	d	6,300	5,000
Toxaphene	0.070	d	d	d	f	e
Trichloroethylene	d	d	d	d	2,000	e
Vinyl chloride	d	d	d	d	e	e
Zinc	170	d	58	d	f	f

[a] These criteria are described in U.S. EPA (1980) and are considered to provide adequate protection to aquatic life. There are no associated permissible exceedance frequencies.

[b] These criteria are described in U.S. EPA (1985a). Each criterion value has an associated permissible exceedance frequency of once every 3 yr on the average.

[c] Where insufficient data were available to derive criteria, concentrations representative of apparent threshold levels for acute and/or chronic toxic affects are described in U.S. EPA (1980). These concentrations, along with associated narrative descriptions, are intended to convey some information about the degree of toxicity of a pollutant in the absence of established criteria.

[d] Criterion has not been established.

[e] Saltwater aquatic life toxicity concentration has not been established.

[f] Since the corresponding criterion value has been established, there is no saltwater aquatic life toxicity concentration cited.

[g] The criteria promulgated in 1985 supersede the criteria promulgated in 1980, and therefore this category is no longer applicable.

REFERENCES

American Public Health Association, American Water Works Association, and Water Pollution Control Federation. 1985. Standard methods for the examination of water and wastewater. 16th Edition. American Public Health Association, Washington, DC.

Barcelona, M.J., J.P. Gibb, and R.A. Miller. 1984. A guide to the selection of materials for monitoring well construction and groundwater sampling. EPA-600/2-84-024. Illinois State Water Survey, Champaign, IL.

Bordner, R., J. Winter, and P. Scarpino. 1978. Microbiological methods for monitoring the environment: water and wastes. EPA-600/8-78-017. U.S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Cincinnati, OH. 337 pp.

Carter, R.W., and J. Davidian. 1968. General procedure for gaging streams. U.S. Geological Survey. Techniques of Water Resources Investigations, Book 3, Chapter A6. U.S. Geological Survey, Arlington, VA.

Driscoll, F.G. (ed). 1986. Groundwater and wells. Johnson Division, St. Paul, MN.

Kister, L.R., and W.B. Garrett. 1983. Field guidelines for collection, treatment, and analysis of water samples - Arizona District. U.S. Geological Survey, Phoenix, AZ.

Pagenkopf, J. 17 June 1987. Personal Communication (phone by Mr. David Nitchals). Tetra Tech, Inc., Arlington, VA.

Plumb, R.H., Jr. 1981. Procedures for handling and chemical analysis of sediment and water samples. Technical Report EPA/CE-81-1. U.S. Environmental Protection Agency/U.S. Corps of Engineers Technical Committee on Criteria for Dredged and Fill Material, U.S. Army Waterways Experiment Station, Vicksburg, MS. 471 pp.

Stofan, P.E., and G.C. Grant. 1978. Phytoplankton sampling in quantitative baseline and monitoring programs. EPA-600/3-78-025. U.S. Environmental Protection Agency, Corvallis, OR. 27 pp.

Strickland, J.D.H., and T.R. Parsons. 1972. A practical handbook of seawater analysis. Bulletin No. 167. Fisheries Research Board of Canada, Ottawa, Canada. 310 pp.

Tetra Tech. 1985. Summary of U.S. EPA-approved methods, standard methods, and other guidance for 301(h) monitoring variables. Final Report. EPA Contract No. 68-01-6938. Prepared for the Office of Marine and Estuarine

Protection, U.S. Environmental Protection Agency, Washington, DC. EPA Contract No. 68-01-6938. Tetra Tech, Inc., Bellevue, WA.

Tetra Tech. 1986a. Water quality assessment of DOD installations/facilities in the Chesapeake Bay region. Phase I report. Data gathering and installation screening. Prepared for U.S. Army Corps of Engineers, Baltimore District. Corps of Engineers Contract No. DACA 31-85-C-0168. Tetra Tech, Inc., Arlington, VA.

Tetra Tech. 1986b. Analytical methods for U.S. EPA priority pollutants and 301(h) pesticides in estuarine and marine sediments. Final program document prepared for the Marine Operations Division, Office of Marine and Estuarine Protection, U.S. Environmental Protection Agency. EPA Contract No. 68-01-6938. Tetra Tech, Inc., Bellevue, WA.

Tetra Tech. 1986c. Bioaccumulation monitoring guidance: 4. analytical methods for U.S. EPA priority pollutants and 301(h) pesticides in tissues from estuarine and marine organisms. Final report prepared for Marine Operations Division, Office of Marine and Estuarine Protection, U.S. Environmental Protection Agency. EPA Contract No. 68-01-6938. Tetra Tech, Inc., Bellevue, WA.

Tetra Tech. 1987a. Water quality assessment of DOD installation/facilities in the Chesapeake Bay region. Phase II report. Development and testing of installation assessment methodology. Prepared for U.S. Army Corps of Engineers, Baltimore District. Corps of Engineers Contract No. DACA 31-85-C-0168.

Tetra Tech. 1987b. Water Quality Assessment of DoD Installation/Facilities in the Chesapeake Bay REgion. Phase III Report. Volume I: Summary; Volume II: Overall Approach, Findings and Recommendations. Prepared for U.S. Army Corps of Engineers, Baltimore District. Corps of Engineers Contract No. DACA 31-85-C-0168.

U.S. Environmental Protection Agency. 1979 (revised March 1983). Methods for chemical analysis of water and wastes. EPA 600/4-79-020. U.S. EPA, Environmental Monitoring and Support Laboratory, Cincinnati, OH.

U.S. Environmental Protection Agency. 1984. Guidelines establishing test procedures for the analysis of pollutants. U.S. EPA, Washington, DC. Federal Register, Vol. 49, No. 209, pp. 43234-43436.

U.S. Environmental Protection Agency. 1985. U.S. EPA Contract Laboratory Program - statement of work for inorganic analyses, multi-media multi-concentration. U.S. EPA, Washington, DC.

U.S. Environmental Protection Agency. 1986. RCRA groundwater monitoring technical enforcement guidance document. Office of Waste Programs Enforcement, U.S. EPA. Washington, DC.

U.S. Environmental Protection Agency. 1987. Quality assurance/quality control (QA/QC) for 301(h) monitoring programs: guidance on field and

laboratory methods. EPA 430/9-86-004. U.S. EPA, Office of Marine and Estuarine Protection, Washington, DC. 267 pp. + appendices.

U.S. Geological Survey. 1977 (revised 1980). National handbook of recommended methods for water data acquisition. U.S. Department of the Interior, U.S. Geological Survey, Office of Water Data Coordination. Reston, VA.

ATTACHMENT 1

EXAMPLE PROTOCOLS
Reference: U.S. EPA (1987)

Biochemical Oxygen Demand (BOD)

Field Procedures --

Collection--BOD samples can be collected in glass or plastic containers. Sample containers and caps should be rinsed thoroughly with sample water before sample collection.

Processing--BOD samples should be analyzed immediately after collection. If a delay occurs, samples should be refrigerated at 4° C to minimize reduction of BOD. Samples should not be stored for more than 48 hours and the length of storage should be recorded on the log sheet. Refrigerated samples should be warmed to 20° C prior to analysis.

Laboratory Procedures --

Analytical Procedures--BOD concentrations should be determined according to U.S. EPA Methods 405.1 or APHA Method 507. Samples having more oxygen-demanding materials than the amount of oxygen in air-saturated water should be diluted to balance the oxygen demand and supply. If samples are diluted, nutrient addition (i.e., nitrogen, phosphorus, trace metals) and pH buffering of the dilution water are necessary to ensure that the sample is suitable for bacterial growth. To prevent air from infiltrating the incubation bottles, a water seal should be used. When samples are incubating, all light should be excluded to prevent photosynthetic production of oxygen. Samples containing caustic alkalinity or acidity should be neutralized to ph 6.5-7.5 using sulfuric acid or sodium hydroxide. Samples containing residual chlorine must be dechlorinated (e.g., using sodium thiosulfate).

Calibration and Preventive Maintenance--Dissolved oxygen concentrations should be measured on all dilution water blanks and seed controls. The dissolved oxygen uptake of the dilution water should not exceed 0.2 mg/L. The dissolved oxygen uptake of seeded dilution water should be between 0.6 and 1.0 mg/L. A glucose-glutamic acid standard check solution should be incubated with each batch of samples. Dissolved oxygen measurements should be calibrated according to accepted procedures (e.g., see descriptions of the Winkler and probe methods in this document).

Quality Control Checks--The dilution water blank provides a quality control on the dilution water as well as on the cleanliness of analytical equipment (e.g., incubation bottles). Each sample should be analyzed at a minimum of three different dilutions to ensure that dissolved oxygen uptake is in the optimal range. Optimal dissolved oxygen uptake is at least 2 mg/L after the incubation, with a residual dissolved oxygen of at least 1 mg/L in the sample. Duplicate analyses should be conducted on at least 10 percent of the total number of samples.

APHA (1985) should be consulted for methods of correcting for the many kinds of interference that may accompany BOD analyses.

Corrective Action--If the dilution water blanks exceed 0.2 mg/L, cleanliness of containers and water should be checked. Containers may require 1+1 HCl rinse after detergent washing to remove any residual organic material. Containers rinsed with acid should be thoroughly rinsed with distilled water to prevent any acid carryover.

If a 2-percent dilution of the glucose-glutamic acid standard check solution is outside the range of 200 ± 37 mg/L, BOD determinations made with the seed and dilution water should be rejected. The problem, which could arise from numerous sources, may be identified by running a series of dilution water blanks using different water sources with and without seed, preparing a fresh solution of glucose-glutamic acid, changing the seed, or preparing fresh reagents for the dilution water. The source of the problem needs to be determined before performing any additional BOD analyses.

Data Quality and Reporting--Precision data for spiked natural waters indicate that standard deviations of ±0.7 and ±26 mg/L can be achieved for BOD concentrations of 2.1 and 175 mg/L, respectively (U.S. EPA 1979b). There is no acceptable method for determining the accuracy of the BOD test. BOD data should be reported as mg/L to the nearest 0.1 unit. Results for all determinations should be reported, including QA replicates, dilution water blanks, and glucose-glutamic acid standards. Any factors that may have influenced sample quality should also be reported.

Dissolved Oxygen (Probe Method)

Field Procedures --

Collection--Oxygen samples should be the first ones collected from the sampler and they should be collected immediately after the sampler is brought on board. It is recommended that a piece of soft-walled rubber tubing be connected to the discharge valve of the sampler to prevent air bubbles from contaminating the sample during collection. The tubing should be soaked in seawater prior to use to prevent air bubbles from collecting inside.

After being attached to the sampler, the plastic or rubber tubing should be flushed with sample water to remove air bubbles. The sample bottle and stopper should then be rinsed thoroughly with sample water. After rinsing, the tubing should be inserted to the bottom of the sampling bottle. The bottle should be filled slowly until at least half full, and then filled rapidly thereafter. At least one full bottle volume of sample should overflow the bottle before the tubing is removed, After the tubing is slowly removed, the stopper should be carefully put in place with a twisting motion while water is displaced from the bottle. Once stoppered, the sample should be checked for air bubbles, If bubbles are present, the sample should be discarded and a new sample collected.

Processing--Because no reagents are used to preserve the oxygen samples, analyses should be conducted immediately after collection. If a delay occurs, it should be noted on the log sheet.

Laboratory Procedures --

Analytical Procedures--Detailed analytical procedures should be provided by the manufacturer of the dissolved oxygen meter. General procdures are listed in U.S. EPA Method 360.1 and APHA Method 421F.

Several precautions should be taken when making measurements with a membrane electrode. First, constant turbulence should be provided by a stirrer to ensure precise measurements. Second, adequate time should be allowed for the instrument to warm up before measurements are started and, when individual samples are analyzed, for the probe to stabilize to sample temperature and dissolved oxygen. Third, reactive gases, such as chlorine and hydrogen sulfide, pass through the membrane probes and may interfere with the analysis or desensitize the probe. Finally, broad variations in the kinds and concentrations of salts in samples can influence the partial pressure of oxygen in samples and thereby affect measurement accuracy.

Calibration and Preventive Maintenance--Calibration procedures should follow the instructions given by the manufacturer of the dissolved oxygen meter. The meter generally can be calibrated using one of three methods: Winkler titration, saturated water, or air. The air method is simplest and

quite reliable. Overall error is diminished when the probe and instrument are calibrated under conditions of temperature and dissolved oxygen that match those of the samples. Calibration can be disturbed by physical shock, touching the membrane, or desiccation of the electrolyte.

Preventive maintenance procedures should follow the manufacturer's recommendations. The oxygen probe should always be stored in a humid environment to prevent drying out and the need to frequently replace membrances.

Quality Control Checks--The instrument should be calibrated at the beginning of each series of measurements and after each group of 10 successive samples. Duplicate measurements should be made on at least 10 percent of the total number of samples.

Corrective Action--If the dissolved oxygen meter does not appear to be operating correctly, consult the manufacturer's troubleshooting guidelines for remedial actions.

Data Quality and Reporting--Repeatability of dissolved oxygen measurements using a membrane electrode should be 0.1 mg/L and accuracy should be ± 1 percent (U.S. EPA 1979b). Sensitivity of the electronic readout meter for the output from the dissolved oxygen probes should normally be 0.05 mg/L (U.S. EPA 1979b). Dissolved oxygen concentrations should be reported in mg/L to the nearest 0.1 unit. Results should be reported for all determinations, including QA replicates. Any factors that may have influenced sample quality should also be reported.

Priority Pollutant Metals

Field Procedures --

Collection--As with water samples, the best containers for collection of sediment for trace metal analysis are made of quartz or TFE. Because these containers are expensive, the preferred containers are made of polypropylene or linear polyethylene with a polyethylene cap (APHA 1985). Borosilicate glass containers can be used and may be preferred if trace organic compound analyses are to be performed on the same samples. Do not use soft glass containers or containers with aluminum-lined or cardboard-lined lids.

Possible problems during sample collection involve contamination from the sampling device, airborne dust, or cross-contamination from previous samples. Contamination can be minimized by avoiding the use of metal when collecting sediment samples. If metal must be used, corrosive resistant stainless steel is the best material. When using a benthic grab or coring device, contamination can be minimized by removing only sediment that is not touching the walls. Prior to use, sample containers should be thoroughly cleaned with a detergent solution, rinsed with tap water, soaked in acid, and then rinsed with metal-free water. All glass or plastic parts associated with the sampling equipment should be cleaned in the same manner. For quartz, TFE, or glass containers, use 1+1 HNO_3, 1+1 HCl, or aqua regia (3 parts concentrated HCl + 1 part concentrated HNO_3) for soaking. For plastic material, use 1+1 HNO_3 or 1+1 HCl. Reliable soaking conditions are 24 h at 70° C (APHA 1985). Do not use chromic acid for cleaning any materials. For metal parts, clean as stated for glass or plastic, except omit the acid-soak step of the cleaning procedure. Acids used should be at least reagent grade. If trace organic compound analyses are to be performed on the same samples, final rinsing with acetone and then high-purity methylene chloride is acceptable.

A minimum sample size of 5 g (wet weight) is required for the analysis of all priority pollutant metals. To allow for duplicates, spikes, and required reanalyses, a minimum sample size of 50 g (wet weight) is recommended. To allow for mixing of the sample and ease of collection, a 240-mL (8-oz) jar is recommended for collection. A 123-mL (4-oz) jar would be adequate but often difficult to fill.

Processing--Samples should be stored in clean containers after collection, and packed in ice while in the field. Samples should be stored at -20° C. Although freezing is not required for all U.S. EPA procedures, it is recommended to minimize potential alteration of analytes by microbes. Care should be taken to prevent container breakage during freezing. Leave sufficient headspace for water to expand and place the containers at an angle when freezing.

No recommended holding time for sediments has been established by U.S. EPA. A maximum holding time of 6 mo (except for mercury samples, which should be held a maximum of 30 days) is consistent with the maximum holding time recommended by the U.S. EPA for water samples (U.S. EPA 1985).

Laboratory Procedures --

Analytical Procedures--Priority pollutant metals should be analyzed according to procdures described in Tetra Tech (1986a). Prior to removing each aliquot for analysis, samples should be mixed thoroughly using nonmetallic utensils. Mix all water back into the samples. If there is any question regarding nonrepresentative material (e.g., twigs, leaves, shells, rocks, and any material larger than 1/4-in), U.S. EPA shold be contacted for guidance. A separate aliquot should be analyzed for a total solids determination.

Digest sediment samples prior to analysis using the acids specified in the procedure (Tetra Tech 1986a). The digestate can then be analyzed by flame Atomic Adsorption Spectrophotometry (AAS), graphite furnace AAS, or Inductively Coupled Plasma (ICP), depending on the sample concentrations and required detection limit. Mercury digestion and analysis must be performed on a separate sample aliquot by cold vapor AAS.

ICP can be used to screen samples for elements that are present in relatively high concentratons. For those that may require more sensitive analysis, graphite furnace AAS can be used. Analysis by ICP can be subject to interelement interferences, while graphite furnace AAS can be subject to matrix problems from acid or salt content of the samples. Select the method with a detection limit that is adequate to determine compliance with 301(h) program criteria.

Calibration and Preventive Maintenance--In general, all instruments must be calibrated daily and each time the instrument is set up. For each analysis, calibration procedures shold follow those for the specified method. Calibration standards must be prepared using the same concentrations of acids as will result in the samples following sample preparation.

After an instrument has been calibrated, verify the accuracy of the initial calibration by the analysis of certified control solutions at a frequency of once every 10 samples or every 2 h during an analysis run, whichever is more frequent, and after the last analytical sample. If a certified control solution is not available, use a standard that is composed of the analyte from a different source than that for the initial calibration. If the deviation of the continuing calibration verification is greater than the calibration control limits specified in the method, the instrument must be recalibrated, and the preceding 10 samples reanalyzed.

All equipment should have scheduled routine preventive maintenance, and a record of all maintenance performed should be noted in a logbook. Critical spare parts should be kept on hand.

Quality Control Checks--Analyze standard reference materials (SRM) [e.g., the National Bureau of Standards (NBS) Estuarine Sediment or the National Research Council of Canada (NRC) Marine Sediments] to provide a check on digestion efficiency and overall accuracy of the analysis. A minimum of one SRM should be analyzed for each survey or 2 percent of the total number of samples (i.e., 1 per 50 samples), whichever is more frequent.

To estimate precision, 5 percent of the total number of samples should be analyzed in duplicate or one duplicate for each survey, whichever is more frequent. When more than 20 samples are to be analyzed for one survey, the project manager may choose to implement a program of triplicate analyses. The overall percentage of replicates should be at least 5 percent. To estimate recovery, analyze samples spiked before digestion at the same frequency as duplicates. Add spike concentration approximately equal to the concentration found in the unspiked sample. An acceptable range in spike concentrations is 0.5 to 5 times the sample concentrations.

Carry a method blank through all digestion and analysis steps at a minimum frequency of once every 20 samples or once for each batch of samples analyzed, whichever is more frequent. If the concentration of the blank is less than the required detection limit, no correction of sample results is performed. If the blank contamination is extensive (>30 percent of sample value) then the batch of samples associated with the blank should be reanalyzed. Data should be corrected by the data user for the blank values between the required detection limit and the control limit.

For ICP analysis, additional QC checks should include an interference check sample to verify interelement and background correction factors. For graphite furnace AAS, additional QC checks should include duplicate injections, with the mean value reported. The relative standard deviation of the readings should be within control limits. Otherwise, the sample should be reanalyzed.

Corrective Action--If the concentration of the field or method blank is greater than the required detection limit, all steps in the sample handling should be reviewed. Many trace metal contamination problems are due to airborne dust. Keeping containers closed and rinsing all handling equipment immediately prior to use minimizes dust problems. In the field, mercury-filled thermometers should be handled carefully or avoided because broken thermometers are a potential source of severe mercury contamination. In the laboratory, samples for mercury analysis should be isolated from items such as polarographs or COD reagents.

Poor duplication may be caused by inadequate mixing of the sample before taking aliquots, inconsistent contamination, gross grain size differences, inconsistent digestion procedures, or instrumentation problems.

Poor performance on the analysis of the Standard Reference Material (SRM) or poor spike recovery may be cause for the same reasons as poor duplication. However, if duplicate results are acceptable, poor SRM performance or poor spike recovery may be caused by loss of analyte during

analysis. To check for analyte loss during digestion and for low recovery due to interferences during analysis, spike the sample after digestion and compare the analysis to the predigestion spike. If the results are different, the digestion technique should be adjusted. If the results are the same, dilute the sample by at least a factor of 5 and reanalyze. If spike recovery is still poor, standard additions, matrix modifiers, or another method is required.

Data Quality and Reporting--Report measurements as mg/kg to a maximum of three significant figures on a dry-weight basis. Detection limits can vary widely because of methods and instrumentation. Consult the analytical method to determine expected detection limits, precision, and accuracy. Detection limits actually obtained should be reported for each sample.

The laboratory data summary should include duplicate, spike, and blank results and state clearly if and how any data were blank-corrected. Data to be included in the ODES database should be blank-corrected by the data user. The laboratory data summary should also include the following information to allow independent QA review:

- Digestion procedures
- Quantity of sample digested and final dilution volume
- Percent solids
- Instrument detection limit for each element
- Method of detection (i.e., graphite furnace, flame, ICP, hydride, cold vapor)
- Deviation from the prescribed methods
- Blank associated with sample
- Problems associated with analysis.

For a more thorough QA review, additional documentation (e.g., calibration curves) may be requested.

APPENDIX B

JOINT RESOLUTION ON
POLLUTION ABATEMENT
IN THE CHESAPEAKE BAY

THE ASSISTANT SECRETARY OF DEFENSE

WASHINGTON, D.C. 20301

MANPOWER, INSTALLATIONS AND LOGISTICS

DEFENSE ENVIRONMENTAL LEADERSHIP PROJECT

The Defense Environmental Leadership Project was established in the office of the Director of Environmental Policy, Assistant Secretary of Defense, in January 1984. Simply stated, the purpose of the Leadership Project is to develop innovative solutions to long-term environmental problems and to improve DoD's national leadership position in environmental protection:

- to improve compliance
- to reduce wastes

The project team has taken on some tough issues - problems like hazardous waste management, groundwater protection, risk assessment, solvent recovery, used oil management, and environmental audits. In 1984 the Leadership Project took some important first steps to improve DoD hazardous waste management and expedite construction of hazardous waste storage facilities; a Used Solvent Elimination program has been started and is being implemented by the military services; DoD policy guidance was developed for several critical environmental issues such as groundwater protection, leaking underground storage tanks, and environmental auditing; and DoD entered into several agreements with the EPA to enhance compliance activities. With regard to the latter, the Joint Resolution on the Chesapeake Bay was signed by Secretary Weinberger and Mr. Ruckelshaus in September 1984 and outlines a cooperative program to enhance Chesapeake Bay pollution abatement activities. The Leadership Project is coordinating the DoD efforts under the Joint Resolution, to include exploring new initiatives that would enhance our environmental programs and planning activities.

Looking ahead to 1985, many tasks started in 1984 will bear fruit, and several new activities are planned. These include updating and revision of several DoD environmental policy directives related to hazardous waste management and compliance with new environmental laws and regulations, and new initiatives to reduce wastes and improve compliance. Several underway studies and planned demonstration projects are intended to minimize wastes, especially hazardous wastes, generation and disposal, while other efforts are directed at improving the performance and compliance level of our pollution abatement facilities.

DEFENSE ENVIRONMENTAL LEADERSHIP PROJECT
1717 H Street, N.W., Room 202
Washington, DC 20006
202-653-1273

DoD CHESAPEAKE BAY INITIATIVES

The Defense Environmental Leadership Project is coordinating DoD efforts in the Chesapeake Bay Program and under the Joint Resolution between the EPA and DoD to enhance Chesapeake Bay pollution abatement activities. Current activities include:

- working with EPA Region III as the point-of-contact for DoD, to develop a management tracking system that will be utilized by both agencies to ensure that commitments under the Joint Resolution are accomplished in a timely manner.

- participating in the Executive Council and appropriate committee meetings to ensure DoD representation on policy and operational considerations commensurate with the spirit of the Chesapeake Bay Program.

New initiatives are being explored to enhance DoD environmental programs and planning activities in the Chesapeake Bay region:

- we are evaluating a proposed study to determine the relative contributions of DoD point source discharges to Bay tributaries and the Bay as a whole, with the intent of evaluating appropriate applications of pollution abatement technology at military installations.

- we are starting a program to enhance the performance of DoD wastewater treatment facilities using a site-specific approach of diagnostic analysis, maintenance improvements, and on-site training assistance. We have called this program the Operation, Maintenance, and Training Assistance Program (OMTAP), and are planning a demonstration at several DoD installations in the Bay region in 1985.

- we have drafted revisions to our directive on Natural Resources management to include a requirement for control of non-point source discharges in our land use management and planning activities. Timely implementation will be emphasized in the Chesapeake Bay region.

DoD has made a positive commitment to do its part in reducing pollution and enhancing the living resources of the Chesapeake Bay. The new initiatives which have resulted from the efforts of the Defense Environmental Leadership Project include a fully cooperative role with the Chesapeake Bay Program. We want to ensure that DoD contributions are fully shared and integrated with States' activities and other Federal agencies. Thus we plan to continue to participate to the maximum extent possible.

Environmental Protection Agency/Department of Defense Chesapeake Bay Initiative

a

Joint Resolution

on

Pollution Abatement in the Chesapeake Bay

Background

The Environmental Protection Agency (EPA) in conjunction with the States of Maryland, Pennsylvania, and Virginia, and the District of Columbia have been conducting studies, environmental surveys and assessments and developing strategies for improving and restoring the Chesapeake Bay. Additionally, President Reagan in his State of the Union speech in January 1984 said, "Though this is a time of budget restraints...we will begin the long, necessary effort to clean up...the Chesapeake Bay."

The Department of Defense (DoD) maintains over fifty installations in the Chesapeake Bay Region, encompassing nearly 400,000 acres and in excess of 250,000 personnel. Executive Order 12088 directs the head of each Executive agency responsible for compliance with pollution control standards, to take necessary actions for prevention, control and abatement of environmental pollution for activities under agency control.

DoD has an aggressive National Pollution Abatement Program to construct, replace and/or upgrade pollution abatement facilities. During the past decade, DoD has spent over $180 million for completed projects in the Chesapeake Bay Region (see Attachment 1 for a summary of completed projects).

Additionally, DoD currently has approximately 19 projects under construction in the Chesapeake Bay Region which when completed will be valued at approximately $17 million (see Attachment 2). These projects, plus others still to be programmed, represent a positive DoD commitment to the overall effort to clean up the Bay.

Resolution

DoD and EPA jointly resolve to cooperate to enhance Chesapeake Bay pollution abatement activities by the following actions:

- DoD will give priority consideration to funding pollution abatement projects and studies affecting the Chesapeake Bay. This will include completion of projects in Fiscal Year 1985 listed in Attachment 3 to this Joint Resolution. Additionally, DoD will request Congressional approval for required out-year pollution abatement projects as they are identified; 10 projects have been identified for Fiscal Year 1986, and additional projects are being identified for the period 1987-1990. EPA will review the DoD projects list for adequacy, and will propose additional projects as may be necessary.

- DoD will develop and initiate, as a pilot project, environmental self-auditing of several of its installations in the Chesapeake Bay Region. EPA and DoD will meet at least once a year to evaluate both the pilot project and its findings (see Attachment 4).

- DoD, through its Defense Environmental Leadership Project, will review selected major Pollution Abatement Project design, construction, operation, and maintenance management practices to insure the quality of Chesapeake Bay related environmental improvement work.

- DoD will continue to provide information to EPA or the States necessary to issue or re-issue all major National Pollutant Discharge Elimination System (NPDES) wastewater discharge permits.

- DoD will review existing land management practices at selected installations in the Chesapeake Bay Region and take actions to reduce soil erosion and other pollution from non-point sources located on its installations. EPA and DoD will meet at least annually to review findings and to evaluate any corrective actions taken (see Attachment 5).

- EPA, in cooperation with the delegated States, will act to insure the issuance or re-issuance of all major (and any other installation identified as significant) DoD National Pollutant Discharge Elimination System (NPDES) permits in the Chesapeake Bay Region by September 30, 1985. These permits will contain requirements (including reducing or eliminating toxic pollutants) appropriate to insure the protection of the waters of the Chesapeake Bay. A listing of these installations is included in Attachment 6.

- EPA, in cooperation with the delegated States, will conduct an annual compliance audit inspection at each major DoD installation (or any other DoD installation identified as significant) in the Chesapeake Bay Region (Attachment 6).

- EPA will provide DoD with technical advice and assistance on controlling non-point and other water pollution sources.

Program Review

EPA and DoD will both establish single points of contact for review of progress. A program review to include appropriate State and local agencies will take place at least annually. Program review will include a public meeting to report progress under this Resolution. This Joint Resolution, unless terminated sooner or extended by the signatories, will terminate on January 1, 1990.

AD-A190 074 WATER QUALITY ASSESSMENT OF DOD INSTALLATIONS/FACILITIES IN THE CHESAPEAK..(U) TETRA TECH INC ARLINGTON VA NOV 87 DACA31-85-C-0168

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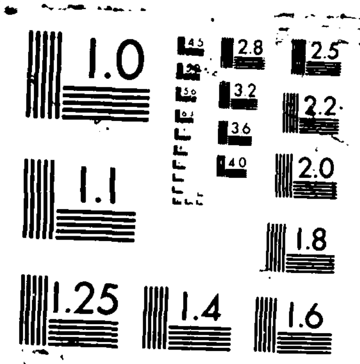
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Effective Date

This Joint Resolution becomes effective when signed by both parties.

Signed this 13th day of September 1984, for the Department of Defense.

Caspar W. Weinberger
Secretary of Defense

Signed this 13th day of September 1984, for the Environmental Protection Agency.

William D. Ruckelshaus
Administrator
Environmental Protection Agency

Summary of DoD Pollution Abatement Projects
Affecting the Chesapeake Bay
Completed During 1974-1984

1. Naval Base Norfolk, VA, Ships Wastewater Collection Systems, approximately $15 million. (1974-1984)

2. Naval Base Norfolk, VA, Oil Spill Prevention Facilities, approximately $49 million. (1974-1984)

3. Naval Shipyard, Portsmouth, VA, Municipal Sewerage Connection, $8 million. (1984)

4. Naval Air Rework Facility, Norfolk, VA, Industrial Waste Pretreatment Plant, $4 million. (1981)

5. Fort Meade, MD, Advanced Wastewater Treatment Plant, $23 million. (1984)

6. Aberdeen Proving Ground, MD, Sewage Treatment Plant Upgrade and miscellaneous Water Pollution Abatement Projects, $6 million. (1974-1984)

7. Fort Lee, VA, Municipal Sewage Connection, $3 million. (1974-1984)

8. Fort Belvoir, VA, Municipal Sewage Connection, $4 million. (1974-1984)

9. Fort Ritchie, MD, Sewage Treatment Plant, $2.5 million. (1981)

10. Ft. Eustis, VA, Sewage Treatment Plant Upgrade, $1.3 million (1982)

11. Ft. Detrick, MD, Sewage Treatment Plant Addition, $2.1 million (1979)

12. Approximately 300 additional smaller Army, Navy, Air Force, and Marine Corps projects in the Chesapeake Bay Region with a combined total cost of approximately $70 million. (1974-1984)

In addition, DoD has in place existing programs, such as integrated pest management at Aberdeen Proving Grounds and Ft. Meade, MD, to minimize use of pesticides.

Attachment 1

Listing of DoD Pollution Abatement Projects
Currently Under Construction in the Chesapeake Bay Region

Installation	Description	Cost($)
New Cumberland Army Depot, PA	Replace Sewer Lines	40,000
Andrews Air Force Base, MD	Repair Storm Drainage	129,000
Langley Air Force Base, VA	Construct Entomology Shop	426,000
Langley Air Force Base, VA	Repair Storm Drainage	496,000
Marine Corps Dev & Ed Cmd, Quantico, VA	Oil Spill Prevention Facility	6,500,000
Naval Supply Center, Norfolk, VA	Mobil Emergency Sewer	40,000
Naval Amphibious Base, Little Creek, VA	Hazardous Waste Storage Facility	87,000
Naval Amphibious Base, Little Creek, VA	PCB Spill Prevention	35,000
Naval Amphibious Base, Little Creek, VA	Sandblast Vacuum System	70,000
Naval Amphibious Base, Little Creek, VA	Piers 10, 25 and 34 Sewers	101,000
Naval Weapons Station, Yorktown, VA	Alterations to Sanitary Sewer	35,000
Naval Weapons Station, Yorktown, VA	Gravity Sewer Line	63,000
Naval Surface Weapons Center Dahlgren, VA	Sewage System Improvements	264,000
Naval Station, Annapolis, MD	Modifications to Sewage Treat. Plt.	42,000
Naval Surface Weapons Center, White Oak, MD	Sanitary/Industrial Waste Connection	1,700,000
Naval Ordnance Station, Indian Head, MD	Sewage System Improvements	6,100,000
Naval Ordnance Station, Indian Head, MD	Industrial Waste Treatment Study	365,000
Naval Air Test Center, Patuxent River, MD	Ship to Shore Sewage Connection	84,000
Naval Research Laboratory, Chesapeake Bay Det, MD	Modifications to Sewage Treatment	140,000
	TOTAL	$16,717,000

Attachment 2

Listing of Planned DoD Pollution Abatement Projects
Scheduled for Accomplishment in the Chesapeake Bay Region in FY 1985

Installation	Description
1. Naval Amphibious Base, Little Creek, VA	Oil Spill Equipment Support Facility
2. Naval Public Works Center, Norfolk, VA	PCB Transformer Containment
3. Naval Air Rework Facility, Norfolk, VA	Hazardous Waste Storage Facility
4. Naval Air Rework Facility, Norfolk, VA	Industrial Wastewater Collection
5. Naval Academy, Annapolis, MD	Pesticide Storage & Transfer Facility
6. Naval Academy, Annapolis, MD	Salt Storage Facility
7. Naval Surface Weapons Center, White Oak, MD	Salt/Sand Mixture Storage Facility
8. Naval Surface Weapons Center, White Oak, MD	Plating Shop Treatment Study
9. Naval Weapons Station, Yorktown, VA	Hazardous Waste Storage
10. Naval Hospital, Bethesda, MD	Pest Control Shop
11. Naval Hospital, Bethesda, MD	Salt Storage Facility
12. Naval Electronic System Activity, St. Inigoes, MD	Extended Aeration Package Plant
13. Naval Shipyard, Portsmouth, VA	Laboratory Addition to IWTP
14. Naval Shipyard, Portsmouth, VA	Ship to Shore Connections
15. Langley Air Force Base, VA	Repair/Replace Sewage Pumps
16. Langley Air Force Base, VA	Install Quick·Disconnects
17. Langley Air Force Base, VA	Repair/Replace Wastewater Line
18. Langley Air Force Base, VA	Repair/Replace Oil Water Sep.
19. Langley Air Force Base, VA	Repair Sewage Lift Station
20. Defense Property Disp. Office, Chambersburg, PA	Hazardous Waste Storage Facility
21. Defense Property Disp. Office, Aberdeen, MD	Hazardous Waste Storage Facility
22. Defense Property Disp. Office, Mechanicsburg, PA	Hazardous Waste Storage Facility
23. Defense Property Disp. Office, Patuxent River, MD	Hazardous Waste Storage Facility
24. Defense Property Disp. Office, St. Juliens Creek, VA	Hazardous Waste Storage Facility

Attachment 3

Listing of DoD Installations in the Chesapeake Bay Region at which Environmental Audits will be Initiated

1. A pilot program of environmental self-audits will be conducted over the next year at the following DoD installations.

Army

Aberdeen Proving Ground, MD
Letterkenny Army Depot, PA
Fort A. P. Hill, VA
Fort Eustis, VA
Fort Monroe, VA
Fort Belvoir, VA

Air Force

Andrews Air Force Base, MD

Defense Logistics Agency

Defense General Supply Center, Richmond, VA

2. Navy and Marine Corps will update environmental engineering surveys already completed for Chesapeake Bay Installations to include compliance with Hazardous Waste regulations. The following installations will be surveyed:

Navy

Naval Academy/Naval Station, Annapolis, MD
Naval Air Test Center, Patuxent River, MD
Norfolk Naval Shipyard, Portsmouth, VA
Naval Base Norfolk, VA

Marine Corps

Marine Corps Development and Education Command, Quantico, VA

Attachment 4

Description of Erosion Control/Runoff Projects/Programs at DoD Installations in the Chesapeake Bay Region

1. The Army has an initiative underway to evaluate the effectiveness of its land management practices at Fort A. P. Hill, VA, and at Letterkenny Army Depot, PA.

2. The Military Services are required to have natural resource/land management plans for their installations. These plans for DoD installations in the Chesapeake Bay Region will be reviewed by the end of fiscal year 1985 to emphasize erosion runoff control for abatement of non-point water pollution sources, and to insure compliance with State and local sedimentation and runoff control regulations.

Attachment 5

Major DoD National Pollutant Discharge Elimination System Permit Installations in the Chesapeake Bay Region

Maryland

Naval Surface Weapons Center, White Oak
Naval Ordnance Station, Indian Head (MD0003158)
Naval Ordnance Station, Indian Head (MD0020885)
Aberdeen Proving Ground
Aberdeen Proving Ground, Edgewood Area
Naval Air Test Center, Patuxent River
David Taylor Naval Ship R&D Center, Bethesda
Ft. George G. Meade

Pennsylvania

Letterkenny Army Depot - Chambersburg

Virginia

Marine Corps Development and Education Command, Quantico
Marine Base Hospital, Quantico
Naval Surface Weapons Center, Dahlgren
Norfolk Naval Shipyard, Portsmouth
Naval Supply Center, Norfolk
Naval Air Rework Facility, Norfolk

Other Significant DoD Installations in the Chesapeake Bay Region

Maryland

Andrews Air Force Base
Naval Surface Weapons Center (Solomons Island)
Harry Diamond Laboratory

Pennsylvania

New Cumberland Army Depot

Virginia

Fort A.P. Hill
Naval Amphibious Base, Little Creek
Naval Supply Center, Norfolk (Craney Island)
Naval Supply Center Norfolk, (Yorktown Fuel Division)

Attachment 6

APPENDIX C

THEORETICAL EFFECTS OF POLLUTANTS ON THE AQUATIC ECOSYSTEM

APPENDIX C

THEORETICAL EFFECTS OF POLLUTANTS ON THE AQUATIC ECOSYSTEM

THE ECOSYSTEM AT RISK

The protection of aquatic life and habitat from adverse effects of point and nonpoint sources of pollution is the central theme of current state and Federal water pollution control legislation. These direct and indirect effects from surface water pollution that may pose a threat to aquatic life and their habitats (Weber, 1981) result from the impact of the pollutants on the quantity and quality of aquatic organisms and habitat, the recreational use of water, the aesthetic quality of the aquatic environment, and the intergrity of the biosphere. The definition of toxicity provided in the Clean Water Act is very explicit and encompasses essentially all the possible adverse effects on all types of organisms. These effects, which are documented in biomonitoring studies, include death, disease, behavior abnormalities, physiological malfunctions, physical deformities, mutations, and cancer. Pollutants may adversely effect the receiving water if they are biostimulatory or toxic. Biostimulation may result from the discharge of dissolved or particulate inorganic or degradable organic macro- and micro-nutrients, which accelerate the growth of heterotrophic bacteria, algae, aquatic weeds, and animals, and generally cause a reduction in species diversity and an increase in standing crop and community metabolism. In contrast, the discharge of toxic substances generally result in a reduction in standing crop and community metabolism as well as species diversity. However, because species vary widely in their response to different types, combinations, and concentrations of pollutants, it is not possible to construct generalizations that are universally valid and therefore, a biomonitoring program is needed to construct a data base of adverse effects for a specific receiving water and the local biota and habitat.

Biomonitoring programs include two basic activities: 1) measurement of the biological properties of the source of pollution, using captive organisms exposed to the pollutant in the laboratory or in the environment and 2) measurement of the effects of the source of pollution on the biological integrity of the receiving waters. The basic properties of aquatic orgamisms include 1) the standing crop or abundance (expressed in terms of numbers of organisms, weight, size, or biomass), 2) community structure (the kinds of organisms present and the relative abundance of each kind, and 3) community metabolism and condition (rates of physiological processes, such as photosynthesis and nitrogen fixation, accumulation of toxic substances, disease, histopathological conditions, parasitism, and flesh tainting).
The characterization of the biological integrity of the selected water body involves describing the trophic structure of the aquatic ecosystems, identifying important organisms, and compiling basic life history information of these species. Selecting important organisms and reviewing their life histories provides specific information about the

aquatic ecosystem. The criterion for selecting important organisms is the contribution of each organism to the ecosystem biomass (evaluated at each trophic level) or its recreational or commercial value. Mobility, reproductive characteristics, and habitat preference or associations are key aspects in the life history of aquatic organism. A knowledge of these characterics of the important species is essential to understanding the biological nature of the aquatic ecosystem, as well as assessment of point and non-point pollution impacts.

The trophic structure of the aquatic ecosystem can be characterized at three or more successive levels of the food web. The nature of the first level concerns the source of fixed carbon or organic material available to the ecosystem. The necessary organic material enters the system as the photosynthetic products of phytoplankton and macrophytes and as detritus. The contribution made by each of these to the aquatic system energy budget greatly influences the resulting trophic structure at higher levels.

The second level of the food web is characterized by herbivorous organisms, which provide the link between primary production and higher trophic levels. This link in the food web can be completed by a wide variety of organisms including copepods, polychaetes, mollusks, amphipods, mysids, and insect larvae.

Characterizing the third level of the food web involves identfying the prevailing trophic relationships between predominant primary consumers and higher order consumers. This information provides an understanding of the major energy pathways in the system, as well as the basic mechanisms which determine the food web structure. Data requirements for characterizing the trophic structure include food items consumed by each organism group, relative preference for each food item, and energy transfer rates between trophic levels.

The degree of mobility demonstrated by aquatic organisms ranges from those which are permanently attached to the substrate to those which actively swim in search of food and exhibit migratory behavior. Cast between these extreme examples of locomotive spectrum are the following groups: burrowing organisms which live in the sediment and move very short distances; planktonic organisms, the movements of which are more or less dependent on currents; zooplankton which exhibit active swimmimg movements allowing them to control their vertical position in the water column; and organisms which are free-swimming only during certain stages of their life cycles. Data requirements for characterizing the degree of mobility include relative mobility (e.g. planktonic, nektonic, or benthic) of each organism or life stage.

Important reproduction characteristics of aquatic organisms include the following: temporal variation in reproductive activity, preferential selection of spawning sites, and migratory behavior. Typically, aquatic organisms display seasonal cycles in reproductive activity; spawning may be limited to a certain period of the year or may take place within a narrow range of temperatures or other conditions. The selection of

spawning sites by mobile organims can be made on the basis of substrate type. For example, substrate type may be especially important to fishes which incubate egg masses in gravel substrates. Migratory behavior can be related to the reproductive condition of aquatic organism; this is best exemplified by anadromous fishes. Data requirements for characterization of reproduction include egg production rate, fecundity, initial spawning temperature, maturation rate to next life stage, spawning habitat preferences (e.g., depth, substrate, salinity), and type of eggs produced (planktonic or adhesive).

The growth rates of individual organism groups are dependent upon a variety of physical and biological factors including feeding rates, assimilation rates, temperature, and food density. Respiration is dependent upon temperature, while mortality depends upon both temperature and the life stage exposed to the toxicant. There are different tolerances to pollutant stress at different life history stages. Data requirements for characterization of growth rates include maximum growth rates, temperature-growth function, maximum density (fish and benthos), assimilation rates of ingested biomass, respiration rates, natural mortality rate, temperature-death function, and toxic response data.

The distribution of many aquatic organisms reflects a preferential physical habitat. Certain groups of demersal fish are often found in association with specific bottom substrates. Other physical characteristics of the water body can influence the distribution of organisms. For example, the seasonal distribution of pelagic fish species is often influenced by vertical temperature and dissolved oxygen gradients. Moreover, the substrate preferences of free swimming larval stages at the time of settling determine the distribution patterns exhibited by the adult stages of many permanently attached benthic organisms.

It is essential to delineate the relationship between preferred habitat types and the designated important organisms. This evaluation should define the areal extent or preferred habitats, the seasonal variation in habitat preference, and the significance of the habitat to various life history stages. Data requirements for characterizing habitat preference include definition of habitat zones for each organism group, temperature, salinity, and dissolved oxygen tolerances, and horizontal or vertical stratification patterns.

The assessment methodology developed for this study utilized available information concerning the biological properties and integrity of the ecosystems within the Chesapeake Bay drainage basin affected by point and non-point source pollution. This information was obtained from published and unpublished reports as well as from the project data base (see Section 2.0 for a description of the project data base). Discussed below are some of the adverse potential effects from pollutants originating on DoD installations.

EFFECTS OF SPECIFIC POLLUTANTS

Suspended Solids

High suspended solids (TSS) in the receiving water results in a number of potential stresses to the ecosystem including limiting light penetration and thus primary productivity; clogging and injuring gills of mollusk, crustaceans, and fish; reducing suitable spawning and territorial areas; creating a BOD demand if high in organics; smothering of benthic organisms and submerged aquatic plants; and sorption of organic materials such as pesticides and of inorganics such as heavy metals. Gammon (1970) found in a study downstream of a rock quarry where suspended solids were increased to 80 mg/l, the density of macroinvertebrates decreased by 60% while in areas of sediment accumulation benthic invertebrate populations also decreased by 60% regardless of the suspended solid concentrations. Neumann et al (1982) found a depressed oxygen consumption in the striped bass as a respiratory response to suspended particle stress of 0.79 g/l. Although considered a short-term response to an acute stress, a chronic response may be an increase in the oxygen carrying capacity of a unit volume of blood by an increase in hematocrit. This would reduce energy available for other physiological functions. Auld and Schubel (1978) found that concentrations of suspended sediments, ranging from a few mg/l to 1000 mg/l, were not lethal to eggs and larvae of the following fish species; blueback herring, alewife, shad, yellow perch, white perch, and striped bass, which are all common to the Chesapeake Bay. The undeveloped gill present on the larvae will not be readily clogged. Also, the eggs may be pre-adapted to the turbid estuarine environment. They stress that only clean, uncomtaminated sediments were used and that chronic effects have not been adequately investigated. The elevated levels of TSS could result in additional transport and dispersion of pollutants due to sorption of organic materials such as pesticides or inorganics materials such as heavy metals. The theoretical adverse effects of these sorbed materials are discussed below.

Dissolved Solids

Dissolved solids consist of both organic and inorganic molecules and ions that are in true solution in water. The more conspicuous of these materials are carbonates, chlorides, sulfates, phosphorus, and nitrates. These anions occur in combination with such metallic cations as calcium, sodium, potassium, magnesium, and iron to form ionized salts. Many of these dissolved materials are essential for growth and reproduction in aquatic biota. The harmful effects of increased salt concentrations are caused, not by toxicity of its individual components, but by the high osmotic pressure that is excerted on the cells of the exposed organisms (Sorensen et al, 1979). The osmotic shock can result either in cell dehydration or expansion/flooding of cell contents. Physiological processes important to cell maintenance and growth will be temporarily or permanently reduced.

Sulfates

There is limited information available for adverse effects from sulfates. If anaerobic conditions exist in the receiving water, sulfate is utilized by chemosynthetic bacteria and is reduced to hydrogen sulfide. The fact that hydrogen sulfide is oxidized to sulfates or elemental sulfur upon exposure to well aerated water reduces the exposure time and the threat to biota which would avoid the anaerobic conditions in areas of high hydrogen sulfide. Mobility is a key life history characteristic that would enable a species to reduce the adverse effect of hydrogen sulfide. Some species, such as the polychaete *Capitella capitata*, have adapted to the high hydrogen sulfide levels and associated low dissolved oxygen levels and exploit this habitat through an opportunistic lifestyle.

Nutrients

Nutrients, such as nitrogen and phosphorus, are essential for plant growth and, thus, for primary productivity. This primary production of plant biomass will contribute a food source to the ecosystem either directly through incorporation of the biomass by herbivores or indirectly through incorporation of the detritus by microorganims and invertebrates. However, the overloading of nutrients, especially nitrogen and phosphorus, could result in an eutrophic condition. As nutrient levels increase, phytoplankton (algal) growth is encouraged and more organic matter is produced. Decay of this organic matter consumes oxygen when there is not enough herbivores present to incorporate the biomass directly. If more oxygen is used than is supplied by reaeration or photosynthesis, as often occurs in deep water, the water becomes anoxic (no oxygen) and devoid of most forms of life except anaerobic bacteria. Eutrophication is directly responsible for low dissolved oxygen, blooms of undesirable algae, decrease in water clarity, and subsequent degrading of species composition and water chemistry. Blue-green algal blooms, fish kills, and hydrogen sulfide odors are some indications that a degraded condition exists from eutrophication.

pH

The effects of low pH are related to the dissociation and solubility of pollutants. Toxicity of many compounds increases with a decrease in pH such as cyanide toxicity to fish and the bioavailability of sediment bound manganese. There is also a direct physiological stress to aquatic biota due to disruption of the acid-base balance in their bodies. Avoidance behavior as well as increased mortality of susceptible species and life stages can result.

Oil and Grease

A major difficulty encountered in defining theoretical adverse effects of oil and grease is that these are not definitive chemical categories, but include thousands of organic compounds with varying physical, chemical, and toxicological properties. They may be volatile or

nonvolatile, soluble or insoluble, persistent or easily degraded. Field and laboratory evidence have demonstrated both acute lethal toxicity and long-term sublethal toxicity of oils and grease. The No. 2 fuel oil spill in West Falmouth, Massachusetts, in 1969 (Hampson and Sanders, 1969) caused immediate death to a wide variety of organisms. Because of the wide range of compounds included in the category of oil and grease, there are no specific water quality guidelines for this pollutant.

The long-term sublethal effects of oil pollutants refer to interference with cellular and physiological processes such as feeding and reproduction and do not lead to immediate death of the organism. Disruption of such behavior apparently can result from petroleum product concentrations at the 10 to 100 ug/l level, and it has been shown that some petroleum products can harm aquatic life at concentrations as low as 1 ug/l (Jacobson and Boylan, 1973). Bioaccumulation of petroleum products has caused cancer in animals (Blumer, 1970). It has also been shown that marine organisms are capable of incorporating potentially carcinogenic compounds into their body fat where the compounds remain unchanged and can result in biomagnification (Blumer, 1970). Oil pollutants, incorporated into the sediments, can remain unchanged and toxic for long periods if this occurs below the aerobic layer. The persistence of unweathered oil within the sediment could have a long-term effect on benthic community structure or cause the demise of important recreational or commercial species.

Short-term acute lethal effects also result from accidental or extended oil and grease discharges. Oils of any kind can also cause drowning of waterfowl because of loss of buoyancy, exposure because of loss of insulating capacity of feathers, and starvation and vulnerability to predators because of lack of mobility. Lethal effects on fish include coating of epithelial surfaces of gills and preventing respiration and fishkills resulting from biochemical oxygen demand. Benthic life forms are asphyxiated when floating masses become engaged with surface debris and settle on the bottom.

Toxic Substances

Toxic substances are usually defined as chemicals or chemical compounds that impair physical, chemical, and biological processes associated with plants, animals, and ecological habitats. Two classes of toxic substances are recognized as posing a threat to the living resources of the Bay ecosystem: inorganic and organic compounds. The inorganic materials are the metals and include the potentially toxic metals arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), mercury (Hg), tin (Sn), silver (Ag), cyanide (Cn), and zinc (Zn). The organic materials are typically produced by human activities, although a few polynuclear aromatic compounds (PNAs) can occur naturally, and thus augment the synthetic compounds. The main classes of organic compounds are pesticides, phthalate esters, polynuclear aromatic hydrocarbons, metalorganic compounds, alkyl-benzines, plasticisers, polychlorinated biphenyls (PCBs) and other halogenated hydrocarbons, and exotic chemicals associated with ordnance and research activities.

Assessing the effects of toxic substances on biota has always been a difficult task. The toxic organics and heavy metals have generalized effects consisting of histopathological abnormalities, metabolic and fecundity supression, simplification of trophic levels, increase in pollutant tolerant species, and the creation of unsuitable spawning and living conditions. The effects range from rapid death, or acute toxicity, to gradual reductions in spawning success, or chronic toxicity. Months, or years of careful observations may be required to determine chronic effects for one chemical on one species. Effects of chemical mixtures on several species or a community are even more difficult to detect due to the synergistic and antagonistic effects of chemicals in the environment. The effects of toxics in the Bay ecosystem can be masked by the wide fluctuations that occur in the natural ecosystems. Fluctuations in temperature, river flows, and surface runoff can result in variations of population and community parameters normally monitored to test for the effects of toxics on the biota. Cause and effect relationships, observed under laboratory conditions where single organisms, or groups of organisms, are subjected to toxicants, can not be readily transferred to the natural environment. The use of this type of information to interpret the changes in entire flora/faunal communities has achieved only limited success.

Efforts to evaluate the theoretical effects of a chemical in the aquatic ecosystem includes an estimate of the chemical's ability to accumulate in the tissues of resident and migratory representative species, most commonly fish and bivalves. Macek et al (1979) summarizes the three most commonly used terms: bioconcentration, bioaccumulation, and biomagification. Bioconcentration involves the process of chemical substances entering the organism across the gill and/or epithelial tissue, directly from the water. Bioaccumulation includes the process of bioconcentration and also the uptake of chemical substances by foraging. Biomagnification refers to the tissue concentrations of bioaccumulated chemical substances increasing as these materials pass up the food chain through two or more trophic levels. Because bioassay toxicity tests employ concentrations of the chemical substances in high levels compared to ambient conentrations, it is difficult to apply the findings of the toxicity literature to those of field measured surveys or to compare the concentrations to regulatory guidelines. The bioaccumulation data from the field surveys are useful in providing direct information on the actual bioavailability of chemical substances in the environment. This information, along with accompanying information on the physiological condition of the species, aids in interpreting the ecological significance of the elevated concentrations.

Biocides

Agricultural activities account for a large portion of the non-point source pollution to the Chesapeake Bay. Biocides (herbicides, pesticides, etc.) are increasingly used in these activities to increase yields per acre. Herbicides can kill plants by interfering with photosynthesis, respiration, and other aspects of plant metabolism. The

major site of action on plants is the chloroplast, although other sites include the mitochondria, protein synthesis, and membrane permeability. Resistance to herbicides in plants is manifested either in the ability to degrade the parent compound to nontoxic metabolite(s), to complex the compound through conjugation, or to acquire altered binding sites through genetic selection. Degradation of the parent compound may be enzymatically or nonenzymatically controlled. Theoretically, plants may develop resistance to herbicides through similar genetic mechanisms which provide a means of increasing degradation and/or tolerance of the biocide within the plant cell.

The toxic effects of herbicides on heterotrophic organisms is substantially less, especially when the major mechanisms are associated with the chloroplast. Toxicity test for various estuarine animals has supported this hypothesis, although the level of sensitivity varies between species. Alternatively, an increasing concern in recent years has been the discovery of the mutagencity of pesticides and/or pesticide metabolites. Nonmutagenic parent compounds can be activated by either plant or animal metabolism into mutagenic substances.

Ordnance

Ordnance firing into the aquatic ecosystem produces an adverse impact that includes the physical stress of shock waves and the chemical stress of pollutants leaking from exploded ordnances. The shock pressure wave can result in injury to the swimbladders of fish, resuspension of sediments which increase TSS and associated pollutants, and cause avoidance reactions by aquatic mobile biota. Wiley et al (1981) have described the effects of underwater explosions on fish with a dynamic model to predict fishkill. Specific damage to the fish was assessed by observing hemorrhaging, gross damage to internal organs especially the kidneys, and rupture of the swimbladder and body cavity. The chemical stress (toxicity) of organics and heavy metals was described above.

Chlorine

Chlorine and the associated chlorine complexes are toxic to aquatic life and result in physiological stress and avoidance behavior in exposed biota (Breisch et al, 1984). During the chlorination of the treatment plant effluents, simple chlorine species (e.g. $HOCl$ and OCl^-) react with aqueous ammonia and organic matter to produce chloramines, haloorganics, and, when estuarine water is present, bromine complexes. The various compounds formed exhibit different toxicities with respect to the combined or free residuals formed. Monochloramines were the most inhibitory compounds tested (Erickson and Freeman, 1978) on four algae species out of 16 compounds tested. Invertebrates as a group were more sensitive to chloramines than to free chlorine (Goldman et al, 1978). The relative toxicities of free chlorine and combined chlorine may depend on the concentrations tested: at concentrations greater than 0.5 mg/l, free chlorine may be more toxic (Tsai and Tompkins, 1974). In reviewing the literature, Breisch et al (1984) found bivalves demonstrating a higher sensitivity to chlorine than fish or crustacea in

both lethal and sublethal toxicity tests. Latent mortality is an important consideration concerning chlorine toxicity. The grass shrimp Palaemonetes pugio can tolerate 2.5 mg/l TRC for 3 h with only 2% immediate mortality; but by 96 h, follwing the 3 h exposure, 98% of the shrimp had died (McLean, 1973). Similar effects were observed by McLean (1973) for the amphipod Gammarus tigrinus.

Non-biological factors that can affect chlorine toxicity include high temperature, long duration of exposure, low dissolved oxygen, light intensity, and low salinity. The added stress of the indicated factors decreases the tolerance to chlorine toxicity in many estuarine aquatic species. In addition, the life stage and the physical state of the organism can effect the survival rate of exposed organisms. Spawning and embryo development are two life stages that are especially susceptible to chlorine toxicity. Avoidance response as a mechanism for mobile organisms to escape from unfavorable environments is of great biological significance. But, if the discharge of chlorinated water is near the feeding or spawning grounds of aquatic species, the avoidance response which would keep the species away may lead to an imbalance distribution of populations of the species.

LITERATURE CITED

Auld, A. H. and J. R. Schubel. 1978. Effects of suspended sediment on fish eggs and larvae: A laboratory assessment. Estuarine and Coastal Marine Sciences. 6:153-164.

Blumer, M. 1970. Oil contamination and the living resources of the sea. F.A.O. Technical Conference Rome. FIR:MP/70/R-1,11P.

Breisch, L. L., D. A. Wright, and D. M. Powell. 1984. Chlorine and the Chesapeake Bay. A review of research literature. University of Maryland Sea Grant. UM-SG-TS-84-02.

Erickson, S. J. and A. E. Freeman. 1978. Toxicity screening of fifteen chlorinated and brominated compounds using four species of marine phytoplankton. pp. 307-310. In: Jolley, R. L., H. Gorchev, and D. H. Hamilton, Jr., eds. Water Chlorination: Environmental Impacts and Health Effects. V. 2. Ann Arbor Science Publisher, Ann Arbor, Michigan.

Gammon, J. R. 1970. The effect of inorganic sediment on stream biota. Environmental Protection Agency. Water Pollution Control Research Series. 18050 DWC 12/70, USGPO, Washington, D.C.

Goldman, J. C., J. M. Capuzzo, and G. T. F. Wong. 1978. Biological and chemical effects of chlorination at coastal power plants. pp. 291-305. In: Jolley, R. L., H. Gorchev, and D. H. Hamilton, Jr., eds. Water Chlorination: Environmental Impacts and Health Effects. V. 2. Ann Arbor Science Publisher, Ann Arbor, Michigan.

Hampson, G. R. and H. L. Sanders. 1969. Local oil spill. Oceanus. 15:8.

Jacobson, S. M. and D. B. Boylan. 1973. Effect of seawater soluble fraction of kerosene on chemotaxis in a marine snail, Nassarius obsoletus. Nature 241:213.

Macek, K. J., S. R. Petrocelli, and B. H. Sleight III. 1979. Consideration in assessing the potential for, and significance of, biomagnification of chemical residues in aquatic food chains. pp. 251-268. In. Markins, L. L. and R. A. Kimmerle, eds. Aquatic Toxicology. ASTM STP 667, American Society for Testing and Materials, Philadelphia, PA.

McLean, R. I. 1973. Chlorine and temperature stress on estuarine invertebrates. Journal of Water Pollution Control Federation. 45:837-841.

Neumann, D. A., J. M. O'Connor, J. A. Sherk, Jr., and K. V. Wood. 1982. Respiratory response of striped bass (Morone saxatilis) to suspended solids. Estuaries. 5(1):28-39.

Sorensen, D. C., M. M. McCarthy, E. J. Middlebrooks, and D. B. Porcella. 1977. Suspended and dissolved solids effects on freshwater biota: A review. Ecological Research Series. U. S. Environmental Protection Agency. EPA-600/3-77-042.

Tsai, C. and J. A. tompkins. 1974. Survival time and lethal exposure time for the blacknose dace exposed to free chlorine and chloramine solutions. University of Maryland Water Resources Research Center. Technical Publication 30.

Weber, C. I. 1981. Evaluation of the Effects of Effluents on Aquatic Life in Receiving Waters - An Overview. pp. 3-13. In: Bates, J. M. and C. I. Weber, eds. Ecological Assessments of Effluent Impacts on communities of Indigenous Aquatic Organisms. ASTM STP 730.

Wiley, M. L. 1983. Documentation of Fishkill Produced by Underwater Explosions in the Potomac River, Maryland, and verification of a model to predict fishkill. Final Report. Ref. No. UMCEES 83-253 CBL.

Wiley, M. L., J. B. Gaspin, and J. F. Goertner. 1981. Effects of Underwater Explosions on Fish with a Dynamical Model to Predict Fishkill. Ocean Science and Engineering. 6(2):223-284.

APPENDIX D

CHESAPEAKE BAY RESTORATION AND

PROTECTION PLAN EXECUTIVE SUMMARY

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EXECUTIVE SUMMARY

> Improve and protect the water quality and living resources of the Chesapeake Bay estuarine system to restore and maintain the Bay's ecological integrity, productivity, and beneficial uses and to protect public health.

This is the consummate purpose of the Chesapeake Bay restoration and protection program. Achieving it will take time and the commitment of the federal, state and local governments, public and private entities, and citizens.

For several decades as population has been increasing, the water quality and living resources of the Bay have been declining. The evident degradation has led to a number of research and monitoring efforts by various governmental and private institutions to discover the causes.

The largest and most comprehensive of these was the five year study of the Chesapeake Bay conducted by the U.S. Environmental Protection Agency (EPA) in cooperation with other federal, state and private entities. The study findings and recommendations prompted action.

In 1983, the Environmental Protection Agency and the states in the basin formalized their commitment to restore and protect the living resources and environmental quality of the Chesapeake Bay in the Chesapeake Bay Agreement, which states:

> "We recognize that the findings of the Chesapeake Bay Program have shown a historical decline in the living resources of the Chesapeake Bay and that a cooperative approach is needed among the Environmental Protection Agency, the State of Maryland, the Commonwealths of Pennsylvania and Virginia, and the District of Columbia (the states) to fully address the extent, complexity and sources of pollutants entering the Bay. We further recognize that EPA and the states share the responsibility for management decisions and resources regarding the high priority issues of the Chesapeake Bay."

The parties to the Agreement called for the preparation and implementation of coordinated plans to improve and protect the water quality and living resources of the Chesapeake Bay. This Chesapeake Bay Restoration and Protection Plan is the first iteration in response to that charge. It documents the collective implementation activities of the federal and state agencies, party to the Agreement. The plan acknowledges the contributions of local governments, private and public sector groups and citizens and encourages consideration of the Baywide goals and objectives in conducting their programs.

The Plan is structured to address the goals and objectives of the Chesapeake Bay restoration and protection effort, formulated on present understandings about the causes of the decline in the Bay's health and productivity. Each implementation program addresses one, and often more than one, objective.

The Chesapeake Bay Study found that a combination of point and nonpoint sources of nutrients and toxics has degraded the quality of water in the Bay and its tributaries and has contributed largely to the decline in their living resources. Point sources are those which discharge through a pipe or ditch, such as municipal sewage treatment or industrial plants and animal feedlots. Nonpoint pollution is runoff from urbanized areas, construction, hydrologic modification, silviculture, abandoned mines, agriculture, irrigation return flows, waste disposal, and individual sewage disposal. The loss of submerged aquatic vegetation, mostly due to turbid waters and decreased sunlight, and the decline of oysters, freshwater spawning finfish, and benthic organisms are of major concern. The Plan describes the goals, objectives and strategies which focus on those concerns.

Because the Bay is a complex interactive ecosystem, actions taken in any part of the watershed may affect a downstream environment. It is, therefore, crucial to have a cooperative effort among the governing agencies of the area. Each state, party to the Chesapeake Bay Agreement, is implementing programs to meet the requirements of its own statutes and regulations and also is working with its neighboring states, the federal government, local governments and private entities to attain mutual benefits for the Bay. The state/federal institutional base prescribed in the Agreement is designed to forge cooperative efforts on the Bay. A Chesapeake Executive Council, composed of leaders of EPA and the key state cabinets, oversees the implementation of coordinated restoration and protection plans. The Citizens Advisory Committee provides independent advice to the Executive Council. An Implementation Committee guides and reports to the Council on state and federal program efforts. Advising the Implementation Committee is a Scientific and Technical Advisory Committee.

This institutional structure is a flexible, non-binding one; yet, it reflects the commitments of the parties to the Agreement to restore and protect the Bay. These federal and state parties have provided the political support and considerable financial backing for both site-specific, discrete state efforts and Baywide undertakings. A significant accomplishment of the participants in the Agreement has been to agree on an overall purpose for the restoration and protection plan, as well as goals and objectives for controlling nutrients and toxics, protecting and restoring the Bay's living resources, addressing other related matters, and supporting a cooperative approach in managing the Bay.

Nutrients

Goal: Reduce point and nonpoint source nutrient loadings to attain nutrient and dissolved oxygen concentrations necessary to support the living resources of the Bay.

Scientific studies have shown that excessive nutrient loadings produce high nutrient concentrations in the water column, resulting in an increase in the microscopic floating plants called algae. The increase of the algae prevents light from reaching the submerged grasses; and, as the algae decompose, they contribute to low oxygen conditions which, in turn, can be harmful to both finfish and shellfish. It appears that phosphorus controls the process in tidal-fresh areas such as the upper sections of the Bay and its tributaries, while nitrogen may be limiting in the more saline areas. It has been concluded

that reducing nutrient loadings to the Bay from point and nonpoint sources will reverse the Baywide trend toward nutrient enrichment and begin to restore the environmental quality of the Bay.

The Baywide objectives designed to reduce nutrient loadings are to:

- Provide timely construction of public and private sewerage facilities to assure control of nutrient discharges;
- Reduce the discharge of untreated or inadequately treated sewage into Bay waters from such sources as combined sewer overflows and leaking sewage systems;
- Provide for adequate maintenance, operation and replacement of equipment at sewage treatment facilities;
- Establish and enforce nutrient and conventional pollutant limitations to ensure compliance with water quality laws;
- Reduce the levels of nutrients and other conventional pollutants in runoff from agricultural and forested lands;
- Reduce the levels of nutrients and other conventional pollutants in urban runoff; and
- Reduce pollutant discharges from recreational boats in shellfish growing areas and beach areas used for swimming.

Directed toward meeting these objectives are implementation programs that have existed for a number of years, such as sewage treatment plants, and relatively new programs, such as agricultural best management practices (BMPs.). EPA has provided considerable funding to state and local governments for construction, maintenance and improvements to sewage treatment facilities. This year approximately $84 million is being directed to the Bay area; the states also provide sizable contributions. New sewage treatment techniques for the removal of nutrients (phosphorus and nitrogen) are being tested and on-site sewage treatments and severage lines are being improved. States are stepping up their enforcement efforts to control point sources. As part of an agreement with EPA, the Department of Defense is enhancing its comprehensive National Pollution Abatement Program.

The states have accelerated and expanded their efforts to control nonpoint sources as a priority for solving the problem of nutrient enrichment in the Bay and its tributaries. Aided by agencies of the U.S. Department of Agriculture and approximately $10 million, state efforts to apply best management practices on farms in selected areas have increased dramatically. Stormwater management programs in urban and suburban areas are also being implemented to reduce nutrients associated with sediment from construction sites and streets and roads. State legislatures are appropriating about $14 million this year to control nonpoint source pollution.

The implementation programs address specific locations with their specific problems since the problems and their remedies vary from place to place. Collectively, these remedies will ameliorate the nutrient over-enrichment of the Bay and its tributaries.

TOXICS

Goal: Reduce or control point and nonpoint sources of toxic materials to attain or maintain levels of toxicants not harmful to humans or living resources of the Bay.

Research has shown a relationship between elevated levels of toxic compounds in the sediments and the survival and diversity of individual organisms necessary to have a balanced Bay ecology. In certain areas of the Bay, living resources are threatened by high levels of toxic substances. The major sources of the toxics are industrial facilities and sewage treatment plants. There are over 5,000 permitted dischargers in the Bay basin. For contaminants such as lead, zinc, and many of the organic compounds, urban runoff and atmospheric deposition are also important sources. Runoff containing pesticides from agricultural areas may also contribute to this degradation in some areas of the Bay. Future forecasts indicate that, unless the trend is halted, the sources of toxic substances will continue to grow in number and change in nature.

To achieve improvement, point and nonpoint sources of toxic materials which have been contaminating areas of the Bay need to be reduced, and care should be taken not to resuspend toxicants currently in the sediments. At the same time, degradation to uncontaminated areas must be prevented. The Chesapeake Executive Council, to control toxics, adopted six objectives. They are to:

- Identify and control toxic discharges to the Bay system through implementation and enforcement of the states NPDES permit programs and other programs;
- Reduce the discharge of metals and organics from sewage treatment plants resulting from industrial sources;
- Reduce the discharge of metals and organics from industrial sources;
- Reduce chlorine discharges to critical finfish and shellfish areas;
- Reduce the levels of metals and organics in urban and agricultural runoff; and
- Minimize water pollution incidents and provide adequate response to pollutant spills.

As part of the effort to attain the goal and objectives for reducing toxics, the states are implementing the National Pollutant Discharge Elimination System (NPDES) program by issuing permits for municipal and industrial point sources, monitoring for compliance, and taking enforcement action, as needed. States are, or will be, requiring toxics limitations and are, or will be, enforcing best available technology (BAT) and water quality-based effluent limitations, where needed. Efforts are underway to encourage pretreatment of effluents from industrial sources and to reduce chlorine discharged from municipal sewage treatment plants. To reduce toxics from runoff, stormwater management programs are aimed at developing areas, with some demonstration projects being initiated; pesticide education programs are being established as part of the nonpoint source control effort on agricultural and suburban lands. While the federal and state governments collaborate on all of these endeavors, this cooperative effort is heightened during emergencies, such as oil spills.

Because of the many uncertainties involved in identifying the toxic substances, their sources and effects, considerable monitoring and research efforts are being conducted by several federal agencies and the states to better characterize these substances and their fate. Results of these efforts will guide development of future programs.

Living Resources

Goal: Provide for the restoration and protection of the living resources, their habitats and ecological relationships.

The decline in the living resources of the Bay can be attributed to several factors including pollution, physical loss of habitats, overfishing and major climatic events. The observed relationships among nutrients and toxicants and living resources provide compelling evidence that water and sediment pollution threatens important living resources.

To attain the goal for living resources, the following objectives were established:

- Develop or enhance state fisheries management programs to protect the finfish and shellfish stocks of the Bay;
- Provide for the restoration of finfish stocks in the Bay, especially the abundance and diversity of freshwater and estuarine spawners;
- Provide for the restoration of shellfish stocks in the Bay, especially the abundance of commercially important species;
- Restore, enhance and protect waterfowl and wildlife;
- Restore, enhance and protect desirable species of submerged aquatic vegetation;
- Protect and enhance, and restore where possible wetlands, coastal sand dunes, and other important shoreline and riverine systems;
- Conserve soil resources and reduce erosion and sedimentation to protect Bay habitats; and
- Maintain freshwater flow regimes necessary to sustain estuarine habitats.

The National Oceanic and Atmospheric Administration (NOAA), Fish and Wildlife Service (FWS), Department of Defense (DOD), Corps of Engineers (COE), Soil Conservation Service (SCS), Environmental Protection Agency (EPA), and U.S. Geological Survey (USGS) are working cooperatively with states and local entities, performing data management, monitoring and research projects around the Bay. At least $1.5 million is spent annually to regulate the fisheries industry, assess and enhance fish stock, and ensure that habitats, such as wetlands, are protected.

In addition to developing comprehensive fisheries management programs, states are replenishing fin and shellfish stocks, building hatcheries and fishways, and "planting" shellfish. In FY 86 alone, the states will spend about $14 million on these efforts. Furthermore, a number of state programs are controlling shoreline erosion, protecting wetlands, and re-establishing submerged aquatic grasses. Approximately $12 million to restore and protect habitats will be expended by states in FY 86.

These efforts, combined with accelerated and expanded programs to reduce nutrients and toxics entering the Bay system, are expected to produce significant improvements.

RELATED MATTERS

Goal: Develop and manage related environmental programs with a concern for their impact on the Bay.

It has become increasingly apparent that "cross-media" environmental pollution is a serious problem. Air deposition, leachate from waste dumps, residuals from industries and sewage treatment plants, and contaminated spoil from dredged areas are now recognized contributors to Bay pollution. An integrated approach to environmental problem solving has been acknowledged in the formulation of the following objectives:

Manage sewage sludge, dredged spoil and hazardous wastes to protect the Bay system;
Manage groundwater to protect the water quality of the Bay;
Consider and address the impacts of atmospheric deposition on the Bay system;
Improve and maintain public access to the Bay including public beaches, parks and forested lands; and
Improve opportunities for recreational and commercial fishing.

To address these concerns EPA and other federal agencies are administering major environmental laws. The states are routinely managing their environmental problems, implementing federal programs and their own laws and regulations.

Further, the states are actively improving access for people to enjoy the benefits of the Bay and its tributaries---swimming, boating and fishing.

INSTITUTIONAL/MANAGEMENT

Goal: Support and enhance a cooperative approach toward Bay management at all levels of government.

The Chesapeake Executive Council and many federal, state, regional, and local public and private entities are already working in support of this goal. Voluntary as well as mandatory programs are being expanded to meet the following Baywide objectives:

Adequately coordinate Bay management activities and develop and maintain good mechanisms for accountability;
Assure a continuing process of public input and participation;
Enhance Bay-oriented education opportunities to increase public awareness and understanding of the Bay system;
Track and evaluate all activities which may impact estuarine water quality and resources;
Develop a coordinated Chesapeake Bay data management system;
Implement a coordinated Baywide monitoring program; and
Implement a coordinated Baywide research program.

Each state and federal agency is working within its own requirements and is cooperating in the Baywide effort, as well. States are evaluating their initiatives on an annual or biennial basis. The agencies are committed to expanding public participation and education programs. Major new educational efforts are involving farmers in the application of best management practices to reduce soil erosion, with its accompanying nutrients and toxicants.

To support efforts to plan for, manage, track and evaluate these programs, approximately $18.5 million is provided by EPA alone. Federal and state agencies continually are collecting and analyzing data to measure results so they can determine if remedial programs are meeting their own objectives and those established Baywide.

Measuring progress in the longer-term are comprehensive monitoring, research, modeling, and data management strategies. To help tie pollutant loadings to effects on water quality and living resources, about $5 million is being spent by federal and state governments annually on monitoring. Another $5 million is supporting research each year to better define present problems and avoid new ones.

As these activities reveal more information and current initiatives are evaluated, we will be better able to predict results and therefore better manage the restoration and protection of the Bay. Then, more streamlined, numerical objectives will be crafted and implementation programs will be reviewed and modified, as needed.

The Chesapeake Bay Restoration and Protection Plan demonstrates that action to clean up the Bay has begun. The states and federal government are using the Plan as a tool for defining and shaping both short-term and long-term commitments. These commitments are crucial if we are to renew and restore this national treasure---the Chesapeake Bay.

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